

# *Discovering the drivers for corporate investments or divestments in the European downstream oil sector*

An application of  
Transaction Cost Economics and of  
Q methodology research

**Sotirios Konstantelos**

**Master Thesis Research**

MSc in Management of Technology

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# ***Discovering the drivers for corporate investments or divestments in the European downstream oil sector: An application of Transaction Cost Economics and of Q methodology research***

## **Master Thesis Research**

MSc in Management of Technology (MoT)

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Sotirios Konstantelos

Delft, November 2014

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# I. Executive Summary

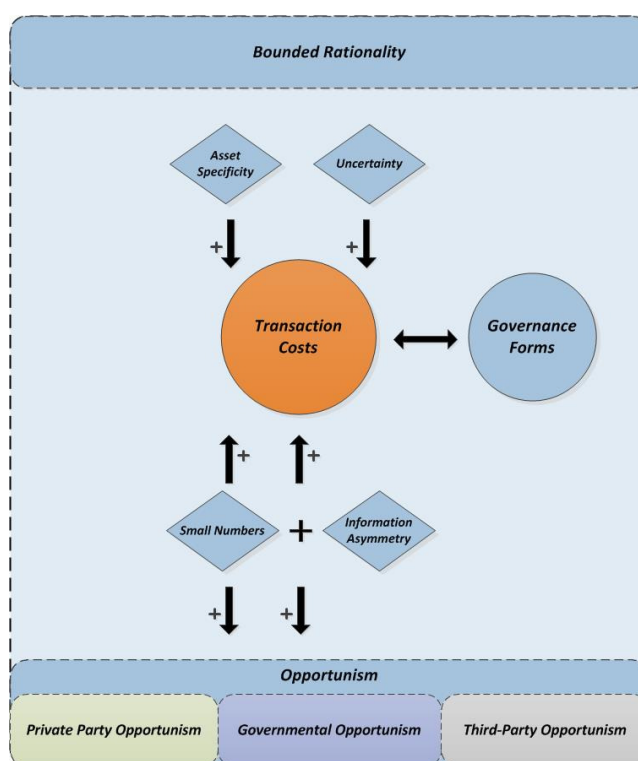
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The European downstream oil sector has seen drastic changes over the past years and particularly after 2008 and the outbreak of the financial crisis. The developments which have taken place have put the sector under serious pressure, which was mainly felt by the European refining industry. In a nutshell, the industry has been greatly affected by the declining demand for oil products in Europe, the imbalance between gasoline and diesel supply and demand in the European market, the changing crude oil qualities with which European refineries are being supplied, the refining overcapacity in the region, the thin margins and high energy costs and finally, the stringent environmental legislation of European Union about oil fuels. Additionally, the sector faces increasing competition from its counterparts in the US, Middle East, Russia and other emerging countries in Asia, not only in Europe but also in other global markets.

However, companies involved in European downstream oil sector react differently to these challenges and whereas some are divesting, others are able to see investment opportunities. Moreover, some companies involved in the petroleum refining, oil products storage and trading business, are moving from refining to trading and vice versa, thus switching their business models and responding with different strategies to the dynamics of this sector. The spectrum of drivers behind corporate decisions concerning these strategies is quite wide and this research has aimed to identify which are the important incentives underlying the decisions of these companies.

The research effort to discover these drivers comprises two main phases; in the first, it was necessary to try to describe the unique characteristics of the European downstream oil sector with the use of theory. The solution was found in combining the Transaction Cost Economics (TCE) and Transaction Cost Regulation (TCR) (Spiller, 2011) theories in a new theoretical framework, customized to depict the idiosyncratic nature of this sector. This was achieved by critically evaluating the constructs offered by these theories for their applicability with respect to the goals of this research, and by considering their limitations and strengths. The point-to-point analysis revealed that from the six main constructs of TCE, namely asset specificity, uncertainty, information asymmetry, small-numbers issues, governance structures and transaction frequency, only the latter is certainly not appropriate for describing the European downstream oil sector. At a lower level of detail, not all of the different theoretical dimensions of asset specificity and uncertainty were found to be useful for the purposes of this research. It is hence argued that site, physical and temporal asset specificities are indeed present in the sector, whereas human asset, dedicated asset and brand name capital specificities are not. The same line of reasoning stands for uncertainty, as it is argued that behavioural uncertainty is insignificant in the European downstream oil sector, as well as the technological uncertainty in the environment. On the other hand, there are high levels of demand volume and political uncertainty, alongside with high unpredictability of the environment. The next step was to consider the limitations of TCE and complement it with TCR in order to compensate for these limitations. TCE is concerned with the risks by the opportunistic behaviours of exchange parties in a transaction, mainly in the case of private parties (private corporations etc.). However, governments and other political institutions are active actors in the European downstream oil sector, which translates to high risks from opportunistic behaviours by governments or other third-parties. TCR takes into account these risks and this is why this theory was chosen to complement TCE for the purposes of this research. A detailed analysis explained how and why TCR theory, which was initially developed for application in the utilities sector,

can also be of great usefulness for the downstream oil sector. In the end, the final theoretical framework proposed, combining elements from both TCE and TCR, is considered as suitable and adequate for describing the nature of the European downstream oil industry, as well as of other industries with similar characteristics. This framework is presented in the following figure.



The second phase of the research is mainly concerned with the use of the Q methodology research technique. The use of this technique helped to identify the truly important drivers for investments or divestments in the European downstream oil sector, according to the perception of stakeholders in this sector. The process of conducting the Q methodology research started with the identification of the concurrence, in other words, of all types of sources which contain ideas, opinions and knowledge statements about the topic at stake. For this step, an extensive literature review took place, resulting in the collection of 384 items (statements). These were all highlighting, explicitly or implicitly, reasons for proceeding with all types of investments or divestments in the European downstream oil sector. Subsequently, from the initial list of items, the Q set for this study was generated. In this effort, the theoretical constructs of the TCE/TCR framework played a pivotal role, as they enabled the author of this thesis to generate the final 42 items of the Q set. The next step was to conduct 13 Q methodology interview sessions with individuals-experts on the topic, who are related to private parties, public parties and also to research institutions. The Q set was presented in front of them and they evaluated the 42 items according to their level of agreement or disagreement with them. Statistical analysis of the data from the interviews allowed for the extraction of three Factors, which represent three ideal viewpoints of participants with respect to the drivers for investments or divestments presented by the Q set items. Moreover, the results of the statistical analysis gave an overview of the areas of consensus or controversy between participants, about what is driving corporate investment or divestment decisions in the sector. At a lower level of detail, with the use of the qualitative information extracted from the interviews, it was made possible to reveal the different ideas and beliefs of participants with respect to each one of the 42 items of the Q set. In the end, the most noteworthy items were collected

and presented. The majority of participants, or at least only one of them, strongly agreed or disagreed with at least one of all of these items. Some of the items which received most of agreement opinions are:

*The substantial surplus of refining capacity in Europe can only lead to divestments of refining assets.*

*A major reason for converting unprofitable European refineries to terminals is mitigation of potential closure costs (including environmental, demolition, employee compensation and legal costs).*

*Most European refineries are configured to produce gasoline, however the European market demands more middle distillates, which is a major driver for upgrading investments in refineries.*

*The fall of demand for gasoline in the US market is a significant driver for divestments in the European downstream oil sector.*

*The higher volatility and lower returns from investments downstream, than the ones from investments upstream (crude oil production), are a major driver for divestments of downstream assets in Europe.*

*The mature European downstream market makes attractive the option to divest downstream assets in Europe and refocus on a strong downstream presence in other growth markets.*

Some of the items which received most of the disagreement opinions are:

*Asset-heavy strategies are becoming attractive because of the rise of financing and transaction costs due to regulatory changes in the banking and derivatives-trading environment.*

*A major driver for acquiring downstream assets in Europe is because is a good way to help to serve the growing demand for fuels in Asian countries.*

*A major reason for acquiring storage facilities or converting refineries to storage in Europe, is compliance with compulsory stock obligations.*

*The higher freight costs for moving refined products to Europe from outside the region, than the costs for moving crude oil, is a major reason for investments in refineries located in Europe.*

*The growing competition European refiners face from their US counterparts worldwide, works mostly as an incentive for upgrading and expansion investments in European refineries.*

Apart from the identification of the most important drivers for investments or divestments in the European downstream oil sector, the results of the Q methodology research allowed for an evaluation of the premises of the newly-developed theoretical framework. To put it in other words, these results helped to test the explanatory power of the TCE/TCR framework and to extract conclusions about its applicability and usefulness. It was shown that the framework is capable to explain a large part of the rationale behind corporate decisions for investments or divestments in the European downstream oil sector. Its few limitations can be addressed by complementing it with theories or constructs of theories, which emphasize the specific resources a company has, such as the resource-based view theory. Furthermore, what was proven in this research is that the Q methodology technique can be a promising alternative way to test the predictions of theories such as TCE, when statistical analysis is not an option due to a limited number of available observations. Next to these, this research showcased how the Q set for a Q methodology research can be generated by combining a review of the literature and the use of theory.

To conclude, the results of this research are important for designing appropriate policies on a European and National Government level, in order to ensure the competitiveness of the European downstream oil sector and the security of oil products supply in Europe. These policies should start taking into account the diversity of perceptions about what drives investments or divestments in the European downstream oil sector, if they are meant to be successful in delivering what they are promising.

Furthermore, the results are also useful for firms involved in the business, as they offer insights into how the other actors in the sector think and decrease information asymmetries between the industry side and the policy-makers side. Last but not least, this research revealed that the European downstream oil sector is not capable to solve its competitiveness problems on its own, as the Neoclassical Economics predictions about “self-correcting” market forces are not verified. On the contrary, it seems that it will be necessary to see increased activity in the future from the European Commission or European National Governments, in order to stimulate the industry and restore its competitiveness vis-à-vis other industries worldwide.

## II. Table of Contents

---

|                                                                                                    |     |
|----------------------------------------------------------------------------------------------------|-----|
| <b>I. Executive Summary</b> .....                                                                  | vii |
| <b>II. Table of Contents</b> .....                                                                 | xi  |
| <b>III. List of Figures</b> .....                                                                  | xiv |
| <b>IV. List of Tables</b> .....                                                                    | xiv |
| <b>1. Introduction</b> .....                                                                       | 1   |
| 1.1 Introduction to the research .....                                                             | 1   |
| 1.2 Literature gap .....                                                                           | 4   |
| 1.3 Problem identification and research objectives.....                                            | 5   |
| 1.4 Research Questions .....                                                                       | 6   |
| 1.5 Research Approach .....                                                                        | 7   |
| 1.6 Why Transaction Cost Economics?.....                                                           | 9   |
| 1.7 Q Methodology research: Why and How?.....                                                      | 10  |
| 1.8 Report structure .....                                                                         | 13  |
| <b>2. Dynamics in the European downstream oil sector and corporate investment strategies</b> ..... | 15  |
| 2.1 Remarks about the dynamics in the sector .....                                                 | 15  |
| 2.2 Corporate investment strategies in the European downstream oil sector .....                    | 19  |
| 2.2.1 International Oil Companies (IOCs).....                                                      | 20  |
| 2.2.2 National Oil Companies (NOCs) of producer countries .....                                    | 21  |
| 2.2.3 National Champions .....                                                                     | 22  |
| 2.2.4 Independent Refiners .....                                                                   | 25  |
| 2.2.5 Others.....                                                                                  | 26  |
| 2.3 The increasing importance of storage facilities.....                                           | 29  |
| 2.4 Concluding remarks about the different corporate investment strategies .....                   | 30  |
| <b>3. TCE and TCR in the context of the European downstream oil sector</b> .....                   | 32  |
| 3.1 Transaction Cost Economics .....                                                               | 32  |
| 3.2 The causes of transaction costs.....                                                           | 33  |
| 3.2.1 Bounded rationality.....                                                                     | 33  |
| 3.2.2 Opportunism .....                                                                            | 34  |
| 3.3 TCE constructs and their application in the context of the European downstream oil sector ..   | 34  |
| 3.3.1 Asset specificity.....                                                                       | 34  |
| 3.3.2 Asset specificity and the European downstream oil sector .....                               | 37  |

|           |                                                                                                                              |           |
|-----------|------------------------------------------------------------------------------------------------------------------------------|-----------|
| 3.3.3     | Uncertainty.....                                                                                                             | 42        |
| 3.3.4     | Uncertainty and the European downstream oil sector.....                                                                      | 44        |
| 3.3.5     | Transaction frequency .....                                                                                                  | 48        |
| 3.3.6     | Transaction frequency and the European downstream oil sector.....                                                            | 48        |
| 3.3.7     | Information asymmetry.....                                                                                                   | 49        |
| 3.3.8     | Information asymmetry and the European downstream oil sector.....                                                            | 50        |
| 3.3.9     | Small-numbers issue.....                                                                                                     | 51        |
| 3.3.10    | Small-numbers issue and the European downstream oil sector .....                                                             | 51        |
| 3.3.11    | Governance structures .....                                                                                                  | 52        |
| 3.3.12    | The effects of asset specificity and uncertainty on the choice of governance form in the European downstream oil sector..... | 53        |
| 3.4       | A TCE limitation: Private and public parties' opportunism .....                                                              | 55        |
| 3.5       | Transaction Cost Regulation .....                                                                                            | 57        |
| 3.5.1     | Governmental Opportunism.....                                                                                                | 57        |
| 3.5.2     | Third-party opportunism.....                                                                                                 | 58        |
| 3.5.3     | A final conclusion about governmental and third-party opportunism.....                                                       | 59        |
| 3.6       | Transaction Cost Regulation and the European downstream oil sector.....                                                      | 59        |
| 3.6.1     | Governmental Opportunism and the European downstream oil sector .....                                                        | 61        |
| 3.6.2     | Third-party opportunism and the European downstream oil sector.....                                                          | 62        |
| 3.7       | A new theoretical framework suitable to describe the European downstream oil sector.....                                     | 63        |
| 3.8       | The rationale behind the use of theory in order to describe the European downstream oil sector.....                          | 65        |
| <b>4.</b> | <b>Q methodology research design.....</b>                                                                                    | <b>67</b> |
| 4.1       | Defining the concourse and formulating the Q set.....                                                                        | 67        |
| 4.1.1     | Step 1: Initial literature review.....                                                                                       | 69        |
| 4.1.2     | Step 2: First round of items list refinement.....                                                                            | 70        |
| 4.1.3     | Step 3: Second round of items list refinement .....                                                                          | 73        |
| 4.2       | Identifying the P sample.....                                                                                                | 75        |
| 4.2.1     | Sample size.....                                                                                                             | 78        |
| 4.3       | Conducting the interviews .....                                                                                              | 78        |
| 4.3.1     | Pre-sorting introduction and information.....                                                                                | 79        |
| 4.3.2     | Q sorting procedure.....                                                                                                     | 80        |
| 4.3.3     | Post-sorting information.....                                                                                                | 82        |
| 4.4       | Processing the data and extracting the factors.....                                                                          | 82        |
| 4.4.1     | Factor extraction based on Principal Component Analysis .....                                                                | 83        |
| <b>5.</b> | <b>Analysis of the results and discussion .....</b>                                                                          | <b>85</b> |

|           |                                                                                                                |            |
|-----------|----------------------------------------------------------------------------------------------------------------|------------|
| 5.1       | Extracted Factors .....                                                                                        | 87         |
| 5.1.1     | Factor 1 .....                                                                                                 | 87         |
| 5.1.2     | Factor 2 .....                                                                                                 | 90         |
| 5.1.3     | Factor 3 .....                                                                                                 | 92         |
| 5.2       | Participants' loadings on each factor .....                                                                    | 94         |
| 5.3       | Areas of consensus and disagreement between the factors .....                                                  | 95         |
| 5.3.1     | Consensus between factors .....                                                                                | 95         |
| 5.3.2     | Disagreement between factors .....                                                                             | 97         |
| 5.4       | Discussion .....                                                                                               | 98         |
| 5.4.1     | Consensus among the participants' views .....                                                                  | 100        |
| 5.4.2     | Disagreement among the participants' views .....                                                               | 106        |
| 5.4.3     | Other items .....                                                                                              | 114        |
| 5.4.4     | What counts most? .....                                                                                        | 126        |
| 5.4.5     | Important drivers underrepresented or missing from the Q set .....                                             | 130        |
| 5.4.6     | Assessment of the usefulness and suitability of the TCE/TCR framework .....                                    | 132        |
| <b>6.</b> | <b>Conclusions and Limitations .....</b>                                                                       | <b>144</b> |
| 6.1       | Conclusions .....                                                                                              | 144        |
| 6.2       | Limitations .....                                                                                              | 147        |
| 6.3       | Scientific relevance .....                                                                                     | 148        |
| 6.4       | Practical relevance .....                                                                                      | 150        |
| <b>7.</b> | <b>Reflection .....</b>                                                                                        | <b>152</b> |
| 7.1       | Application of TCE and TCR theories for describing the European downstream oil sector .....                    | 152        |
| 7.2       | Use of Q methodology research technique .....                                                                  | 153        |
| 7.3       | Impact of this research on the domain of Management of Technology (MoT) .....                                  | 155        |
| <b>8.</b> | <b>Recommendations for future research .....</b>                                                               | <b>157</b> |
| <b>9.</b> | <b>Bibliography .....</b>                                                                                      | <b>158</b> |
|           | <b>Appendix A: Dynamics and developments in the European downstream oil sector .....</b>                       | <b>169</b> |
|           | <b>Appendix B: Initial items list .....</b>                                                                    | <b>204</b> |
|           | <b>Appendix C: Items list after 1<sup>st</sup> refinement round .....</b>                                      | <b>246</b> |
|           | <b>Appendix D: Q methodology research data sheet sample .....</b>                                              | <b>250</b> |
|           | <b>Appendix E: Differences and similarities between Principal Component Analysis and Factor Analysis .....</b> | <b>251</b> |
|           | <b>Appendix F: Other tables generated by the PQMethod software .....</b>                                       | <b>252</b> |
|           | <b>Appendix G: Detailed lists of items used for Factors interpretation .....</b>                               | <b>278</b> |

### III. List of Figures

---

|                                                                                                                                  |    |
|----------------------------------------------------------------------------------------------------------------------------------|----|
| Figure 1: The four phases of the research approach. ....                                                                         | 8  |
| Figure 2: A typical Q sort distribution. ....                                                                                    | 12 |
| Figure 3: Demand history of oil products in the EU. ....                                                                         | 15 |
| Figure 4: Net trade flows for refined products. ....                                                                             | 16 |
| Figure 5: Capacity and utilization of European refineries. ....                                                                  | 17 |
| Figure 6: Restructuring of European refineries owned by producer NOCs (2008-2011). ....                                          | 21 |
| Figure 7: Restructuring of European refineries owned by “other” refiners (2008-2011). ....                                       | 27 |
| Figure 8: The six dimensions of asset specificity. ....                                                                          | 35 |
| Figure 9: Relevant dimensions of asset specificity in the context of the European downstream oil sector. ....                    | 42 |
| Figure 10: The different dimensions of uncertainty. ....                                                                         | 43 |
| Figure 11: Relevant dimensions of uncertainty in the context of the European downstream oil sector. ....                         | 48 |
| Figure 12: Common forms of state intervention in the oil industry. ....                                                          | 56 |
| Figure 13: The original TCE theoretical framework (left) and the new theoretical framework proposed in this thesis (right). .... | 64 |
| Figure 14: The six basic steps of Q methodology research. ....                                                                   | 67 |
| Figure 15: Procedure for the formulation of the Q set. ....                                                                      | 68 |
| Figure 16: A systematic approach for reducing the initial list of 384 items in the first refinement round. ....                  | 71 |
| Figure 17: The Q sort distribution of this study. ....                                                                           | 81 |

### IV. List of Tables

---

|                                                                                            |     |
|--------------------------------------------------------------------------------------------|-----|
| Table 1: P sample participants. ....                                                       | 76  |
| Table 2: Correlation matrix between Q sorts. ....                                          | 83  |
| Table 3: The factor arrays (Factor Q-sort values for each item). ....                      | 85  |
| Table 4: Participants’ (significant) loadings on each factor. ....                         | 94  |
| Table 5: Consensus items (those that do not distinguish between any pair of factors). .... | 95  |
| Table 6: Controversial items. ....                                                         | 97  |
| Table 7: Most noteworthy items. ....                                                       | 127 |

# 1. Introduction

## 1.1 Introduction to the research

The European refining sector has been facing a series of challenges and pressures over the past years, which have forced the sector to undergo a period characterized by closures of plants, restructuring processes and asset ownership changes. One of the most important problems the sector has seen, particularly over the period from 2008 (and the outbreak of the European economic crisis) to 2013, is the decreasing demand for oil products in the European market. The overall demand decline was about 13% (FuelsEurope, 2014) and this trend is expected to continue in the future (IEA, 2013b). This is mainly attributable to the increasing efficiency of car engines and to policies of the European Commission (EC) aiming to stimulate the adoption of bio-fuels and of alternative energy sources, mainly in the transportation sector. This drop of overall demand constitutes a major problem for the European refineries as they experience eroding net sales. The problem is aggravated even more from the fact that demand reduction has led to a serious refining overcapacity in Europe, which further diminishes the margins of regional refineries.

However, it is noteworthy that demand rates for specific oil products have been reduced disproportionately, with the one for gasoline falling by 20% over the period 2008-2013, whereas the respective one for middle distillates has fallen only by 7% (FuelsEurope, 2014). This highlights the fact that the European market has been demanding more diesel and other middle distillates, rather than gasoline. This again is largely the result of National Governments policies of certain European countries, intending to promote the use of diesel as a transportation fuel. Nevertheless, increased demand for middle distillates would not necessarily pose a problem if European refineries could supply these products. This is not the case though, as the majority of refineries in Europe are configured to produce more gasoline –because this product was more demanded in the past– and therefore cannot provide what the market currently asks for. However, changing the configuration of a refinery to increase the share of middle distillates in its production mix requires major amount of capital and long lead times. Therefore it is not easy investment decision and it may not be an option for cash-short refiners. This situation has led to a surplus of gasoline and a deficit of diesel and other middle distillates in Europe, constituting the region significantly dependent on imports for its middle distillates consumption. Next to losing market share in the European market for middle distillates, European refineries have been experiencing a loss of sales in their traditional gasoline export market; the US. For reasons which will be analyzed subsequently, the demand for gasoline in the US market has declined significantly over the past years, leaving European refineries with a surplus of gasoline and with no obvious destination to ship it.

All of these problems have eroded the refining margins of European refineries, which have been hit even harder from the higher operating costs in Europe, compared to other parts of the world. These costs are driven mainly by the high energy costs and high feedstock costs. Moreover, most European refineries were initially designed to process light-sweet crude oil qualities, however now, they need to adapt to more heavy and sour crudes. This is due to a decline in North Sea crude production and to turmoil in some of the African producing countries such as Nigeria or Libya over the past years, which have led to a significant decrease in light-sweet crude production. This was accompanied by increased imports of heavier and sourer crudes from countries such as Russia, to be used as feedstock and this import trend is expected to continue in the future (Meijknecht, Correljé, & van Holk, 2012). Hence European refineries have to adapt to this reality, however, adaptation requires again significant

investments in order to be able to process these heavier-sourer crudes. This is even more so if the oil products from European refineries are to comply with the stringent European environmental legislation and the new regulations of the International Maritime Organization, promoting low sulphur oil-based fuels produced with low CO<sub>2</sub> emissions.

All the previous factors are in a sense, regional factors affecting the European refining sector. Nevertheless, there are also pressures stemming from competition overseas, for example from the US refineries. The European refineries have to compete even more against their counterparties in North America, not only in Europe but also in other global markets. Over the past years, exports of US-made middle distillates and gasoline have increased, as a result of increased US refineries production. At the same time US market gasoline imports have declined, not only due to the increased indigenous gasoline production but also due to the increasing share of bio-ethanol in the fuel mix. It has become obvious that US refineries are increasing their production volumes because they are experiencing positive margins, contrary to what is taking place with refineries in Europe. This is attributable to the shale oil and gas revolution in the US, which has enabled regional refineries there to enjoy lower energy and feedstock costs. As a matter of fact, whereas energy costs represent 20% of refining costs for US refineries, this percentage is 60% for European refineries (IEA, 2013a) and the latter's operating costs are not expected to improve through to 2020 (Nelson & CONCAWE, 2013). Next to this, the proximity of these US shale oil and gas production sites to the local refineries contributes to lower transportation costs and hence higher yields for US plants, and this the competition even fiercer for European refineries (Boncourt, 2013). Nevertheless, competition has also arisen and keeps emerging from the newly-built refineries in the Middle East and other emerging countries (Meijknecht, Correljé, & van Holk, 2012); (Boncourt, 2013). These refineries pose a serious threat for their European rivals as, for example, the ones located in the Middle East can "(1) process a variety of heavy and sour crude qualities (2) at low operating costs, (3) usually take advantage of cheap feedstock contracts from the upstream division of their National Oil Companies (NOCs), (4) can rely on the ample availability of private and especially public financing sources at low cost and (5) enjoy strong governmental support" (Meijknecht, Correljé, & van Holk, 2012, p. 41). At the same time, many European refineries are of low complexity, of low scale and positioned in disadvantaged locations, which increases the competitiveness gap with their rivals in the Middle East. However, in countries such as China or India there are also significant investments in new state-of-the-art refineries, which are realized either because of the expected increase in demand for oil products in their domestic market or deliberately for oil product export purposes. New refineries in these countries may also pose serious competition to European refineries in the near future (Oil and Energy Trends, 2014); (Meijknecht, Correljé, & van Holk, 2012). Last but not least, a serious form of competition currently and for the coming years, is originating from Russia. Russian refineries have been exporting products in the European market for years, largely benefiting from the favorable tax regime with respect to exports of crude oil and refined products (Cuthbert, Leavens, Kennaby, & Birch, 2011). Although this tax regime stimulated exports of oil products for years, it acted as a barrier for upgrading investments in Russian refineries which eventually became incapable of providing export markets such as the European one, with the fuels meeting the latest quality specifications. However, this situation has changed, as the Russian government has initiated changes in this taxation regime, which has subsequently incentivized or better say, forced, Russian refineries to proceed with upgrading investments. Indeed, the Russian refining sector is undergoing a major modernization program which will constitute refineries in that region capable to compete with the most sophisticated plants in the world (Oil and Energy Trends, 2014); (Fattouh & Mallinson, 2013). Obviously this will be translated to one more form of serious competition for the European refining sector in the near future, not only in Europe but also in other global markets.

All the aforementioned developments have resulted to a refining sector in Europe, which is changing drastically. Due to these pressures, the profitability of many European refineries has been hit hard and only the ones which can attract the necessary upgrading investments seem likely to survive. Many refineries have been put for sale over the past years and the ones which did not attract any buyers had to close. Indeed, there has been significant refining capacity reduction in the region, either because unprofitable plants have been shutting down their operation or because some have been mothballed. However, demand for oil products is falling faster than capacity is being reduced, which leads to projections for further necessary refinery closures in the near future (IEA, 2013b); (IEA, 2013a). The most likely candidates for future closures are refineries which are of low complexity and scale, and particularly the ones which do not have access to open sea or are not close to a major trading hub. It is interesting to mention that all the refineries which were shut down completely, were eventually converted into storage facilities and terminals. Many of these assets are becoming attractive acquisition targets, not so much for refining companies, but for firms involved in commodity trading as they can use these assets for their business.

Indeed, alongside with closures a restructuring of the ownership of European refineries has been taking place in the sector. Several patterns have been identified within this restructuring process and they are all closely related to investment or divestment strategies of companies of different size or nature (IOCs, NOCs, independent refiners, commodity traders etc.). Following Meijknecht et al. (2012), there are five main groups in which, companies with specific characteristics may fit in: the International Oil Companies (IOCs), the National Oil Companies (NOCs) of producing countries, the “National Champions” (former state-owned oil companies in Europe and emerging markets), the Independent refiners and the “Others”. Companies within every group have usually different perception about the dynamics in the European refining sector and whereas some perceive drivers for divestments, others perceive investment opportunities. Thus, for example, whereas the large vertically integrated IOCs are mostly divesting downstream assets in Europe and are focusing on investments in their upstream businesses, the “National Champions” from emerging markets have invested significantly over the past years by acquiring many of these assets. Of course, many of these companies have different business models so it is reasonable to expect that they would react differently in the developments in the European refining sector. Moreover, it has been noticed that some firms involved in the petroleum refining and oil products storage and trading business, are moving from refining to trading and vice versa, thus changing their business models. All of these firms are responding with different investment strategies to the dynamics in this sector and the spectrum of drivers behind corporate decisions concerning these strategies is quite wide.

Exploring this variety of drivers for corporate decisions to invest or divest in the European downstream oil sector, is what this research aims for. It should be mentioned that from this point and onward, the author of this thesis will be often using the word “downstream” instead of refining. The use of this word implies that the analysis in this report will be referring both on refineries and storage assets or terminals. The reason is that the focus should also be on the latter assets, as these are becoming of increased importance given the dependency of Europe on imports of middle distillates. Therefore trying to discover more about corporate investment or divestment drivers for refining assets cannot be fulfilled, unless the focus is also on these –often called– midstream assets. However, it should be clear that the use of the word “downstream” throughout this report does not imply any reference to retail, distribution-related and marketing assets.

The scope of this thesis research is therefore to identify the major drivers for corporate investments or divestments in the European downstream oil sector, according to how the stakeholders in the business

perceive them. The rationale behind taking the decision to conduct this research will be elaborated in the subsequent paragraphs. It should be mentioned though that in the effort to identify what is driving firms to invest or divest, it is imperative to understand the nature of the European downstream oil sector itself. For this purpose, it is necessary to employ specific theoretical frameworks which can aid the research, and such a framework is the Transaction Cost Economics (TCE) theory. It is believed that TCE offers theoretical constructs which are a good match with the unique characteristics of the European downstream oil sector, and this was firstly highlighted by Meijknecht et al. (2012). However, during this research project it is intended to critically reflect on how well TCE can serve this purpose and after taking into account the limitations of this theory, there is an effort to complement it with the Transaction Cost Regulation (TCR) theory proposed by Spiller (2011). Hence, a new theoretical framework is proposed which has helped to research and classify in an organized manner, the drivers for corporate investments or divestments which could be identified in an extensive literature review. These drivers had then to be evaluated for their validity and importance, according to the perception of real stakeholders involved in the downstream oil business in Europe. To this end, the Q methodology research technique is employed and interview sessions with participants related to different kinds of stakeholders' groups are conducted. In the end, the extracted results are believed to be of high value for a variety of different actors involved both in the public and private sector.

## 1.2 Literature gap

From the introductory discussion it is apparent that the reality of the European downstream oil sector is quite complex and the landscape is constantly changing. The imbalance between the supply and demand of gasoline and diesel in the European market, the changing crude oil qualities with which European refineries are being supplied, the increasing competition European refineries face from the U.S., Middle East and other emerging countries and the stringent European environmental legislation about oil fuels, are among others, all affecting negatively the downstream oil sector. The different ways in which companies involved in European downstream oil business react to these developments, is something which needs to be explored. A better understanding of the motives behind their investment or divestment decisions is crucial, as these decisions might have a great future impact on Europe's security of supply of oil products. Refineries and other downstream infrastructure are considered to be strategic assets of a country's economy and this also applies to European economy as a whole (Correljé & van Geuns, 2011); (Boncourt, 2013). The refining industry for example is not like other industries where the under-performing assets would simply shut down. On the contrary, there are many political considerations to be taken into account when making decisions about refineries. So, it is not uncommon to observe that loss generating refineries might be left operating, due to reasons of maintaining oil-products-imports independency, translated also to increased energy security (Meijknecht, Correljé, & van Holk, 2012); (Boncourt, 2013); (Kemp, 2013). Moreover, the European refining sector was employing in 2013 approximately 140.000 people, and taking into account also the labor force involved in selling and transporting oil products, the figure changes to 600.000 people (FuelsEurope, 2013). Thus, it is obvious that if the pressure the sector is facing will not be adequately mitigated through an appropriate policy framework, the sociopolitical consequences of the future contraction of the downstream oil business in Europe can be significant.

Therefore, the need to have a clearer picture of the changing environment of the European downstream oil sector and of the rationale behind corporate investment or divestment decisions is self-evident. Meijknecht et al. (2012) gave substantial insights into how and why different firms involved in the

European refining business change their investment strategies, with some players investing and others divesting, but there is also a need to better understand how storage assets operators or commodities trading companies react to the developments in the sector. In a nutshell, the major underlying reasons behind the decisions of firms involved in the European downstream oil sector, with respect to investment strategies or shifts of their business models, remain largely unknown.

This is the literature gap which can be identified and the purpose of this thesis research is to “fill” it or at least reduce it. There is awareness of what companies do, what is missing is knowledge of the major drivers behind their actions and the purpose of this thesis project is to explore these drivers. Due to the many different strategies of firms in the downstream oil business in Europe, it is expected that there is diversity among opinions of what drives the investments and what drives the divestments, and also of which of these drivers are of increased importance. In other words, it is expected to notice differences among the perceptions of stakeholders in this sector with respect to the issue at stake, and this thesis research attempts to reveal these differences.

### 1.3 Problem identification and research objectives

Due to the defined literature gap there is a problem for policy makers in the Directorate for Energy of the EC, for policy makers of European National Governments assigned with energy policy formulation tasks, and for corporate strategy and business development managers of companies involved in this sector. Firstly, the lack of knowledge about these reasons hinders the decision making processes of the aforementioned policy makers and thus, limits their capabilities of formulating the right policies which can effectively strengthen the European downstream oil sector and increase its long-run competitiveness. This may have severe consequences for Europe’s future security of oil products supply and for the general sociopolitical and economic stability in the region. Secondly, due to this lack of knowledge, managers in companies involved in the business of supplying the European market with oil products, are not fully aware of the reasons other players in the business choose different strategies in response to the dynamics in the sector. This in turn often prevents these companies from dealing efficiently with the competition. It may be the case that these companies will differentiate their business strategies after becoming more aware of the reasons behind their competitors actions, as the information asymmetry will have been decreased and new considerations may have to be taken into account.

Therefore, the research objectives of the proposed Thesis project are the following:

*“At first, analyze the unique characteristics of the European downstream oil sector by using a combination of the Transaction Cost Economics and Spiller’s Transaction Cost Regulation theoretical frameworks. Subsequently, use the constructs of the theory in order to explore systematically in the literature the major drivers for corporate investments or divestments in the European downstream oil sector, and eventually test the relative validity and importance of these drivers for all the stakeholders involved in the sector. Finally, compare the anticipated different perspectives and draw helpful conclusions for policy makers assigned with formulation of energy, environment and industry-related policies, both in a European and a National Government level. Furthermore, draw useful conclusions also for corporate strategy and business development managers, of companies involved in the business of supplying the European market with oil products”.*

## 1.4 Research Questions

The main research question which can be derived from the aforementioned research objectives is the following:

*“Which are the most important drivers behind corporate decisions for investments or divestments in the European downstream oil sector?”*

In order to answer the main research question, there are also three sub-questions to focus on:

1. *“How well can a combination of TCE and Spiller’s TCR theoretical framework describe the unique characteristics of the European downstream oil sector and help research in a systematic manner the drivers behind corporate decisions for investments or divestments in this sector?”*

TCE seems to be a good starting point for developing a theoretical framework which will help analyzing and describing the special attributes of the European downstream oil sector. This idea originates in the work of Meijknecht, Correljé, & van Holk (2012). Moreover, as TCE has its own limitations when it comes to use it within a downstream oil industry context, the effort is made in this thesis to complement it with Spiller’s TCR theory (2011) in order to compensate for these limitations. In this way, a more solid theoretical framework can be created which is particularly meant to describe the (European) downstream oil sector and to take into account its unique characteristics. Furthermore, the final theoretical framework will provide the key theoretical constructs to be used for guiding the research for corporate investment or divestment drivers that can be identified in the literature. Obviously, there is a strong relation between the downstream oil sector characteristics and the nature of investment or divestment drivers in this business. Thus, gaining knowledge first about the sector can lead to a more systematic identification of these drivers in the literature. In the end, the framework will be tested against the results of the Q methodology research, in order to assess whether it is indeed valid and suitable to depict the rationale behind corporate investment or divestment decisions.

2. *“Which are the most important drivers behind investment or divestment decisions of companies involved in the European downstream oil sector that can be identified in the literature?”*

The answer to this sub-question will stem from a literature review. It is expected to identify a wide set of incentives for corporate investment or divestment decisions in the European downstream oil sector, from an extensive research in both academic and non-academic sources. The constructs of the theoretical framework developed for answering the first research sub-question, will allow for scrutinizing in a systematic way the wide set of drivers and eventually identifying the most important of them. These findings will actually become the “raw material” for answering the third research sub-question, which will involve the Q methodology sessions.

3. *“How do different stakeholders in the European downstream oil sector perceive the aforementioned drivers in terms of validity and importance?”*

After the identification of the most important drivers for corporate investments and divestments in the European downstream oil sector, from the literature review, there will be a need to test them for their

validity and importance. Obviously, no one is better to help in this task than people from the companies involved in this business, as they are the ones who take the decisions for investments or divestments. However, people in companies have often their own, company-specific mind map, which may make them to have a strategic perspective with respect to these drivers. This is why is important to involve in this research, not only people from companies but also people who are collaborating with them, for example from public authorities or research institutes who may be able to “see things from a distance”. Next to this, the oil industry is often characterized by a heavy interaction between private and public parties, therefore it is necessary to include in the research individuals related to public authorities as well. In the end, the corporate investment or divestment drivers identified should be evaluated by all stakeholders involved in this sector. This will help exploring the diversity among perceptions about corporate investments or divestments motivations in the European downstream oil sector. The use of the Q methodology research technique, for reasons that will be analyzed in subsequent paragraphs of this Chapter, is expected to facilitate significantly this exploration process and reveal this diversity.

In the end, the results of the Q methodology research will provide useful material for an analysis which will help to identify the truly important drivers for corporate investments or divestments in the sector. This will be the answer to the main research question of this thesis project.

## 1.5 Research Approach

The research approach for the proposed thesis project can be divided in four distinct phases.

### *Phase 1: Introduction*

As its names states, this is the introductory phase of this research. Two of the main elements of this phase have already been presented, namely the Research Problem and the Research Objective and Questions. However, in order to be able to understand the existing problem and translate it into questions that need to be answered, it was important to investigate thoroughly the dynamics that are taking place in the European downstream oil sector and the different corporate investment strategies. Some of these dynamics were mentioned in the introductory paragraph of this report. However, in Chapter 2 and in Appendix A there is a detailed presentation of all the changes the European downstream oil sector faces. To conclude, it is believed that the description of the dynamics in the European downstream oil sector and of the alternative corporate investment strategies, is offering a comprehensive overview of what has led to the current state of the sector and highlights the motivation for this research respectively.

### *Phase 2: Theoretical Background*

The first step of Phase 2 comprises the literature review concerning the TCE and Spiller’s TCR theories and their application in the context of the European downstream oil sector. All key assumptions and constructs of the TCE and TCR theories are presented and discussed. This is done to offer the reader of this report a wider understanding about the argumentation inherent in these theories. This is accompanied by a careful, step-by-step evaluation of the applicability of these constructs, for describing the characteristics of the sector. This process highlights which elements of the TCE theory can be retained and used for the purposes of this research and which elements should be discarded. Moreover, certain limitations of the TCE theory are emphasized and these are compensated by complementing this theory with TCR. The end result of this whole process is the proposition of a new Theoretical Framework, which combines elements from both TCE and TCR and is believed to be particularly suitable for describing the nature of the (European) downstream oil sector.

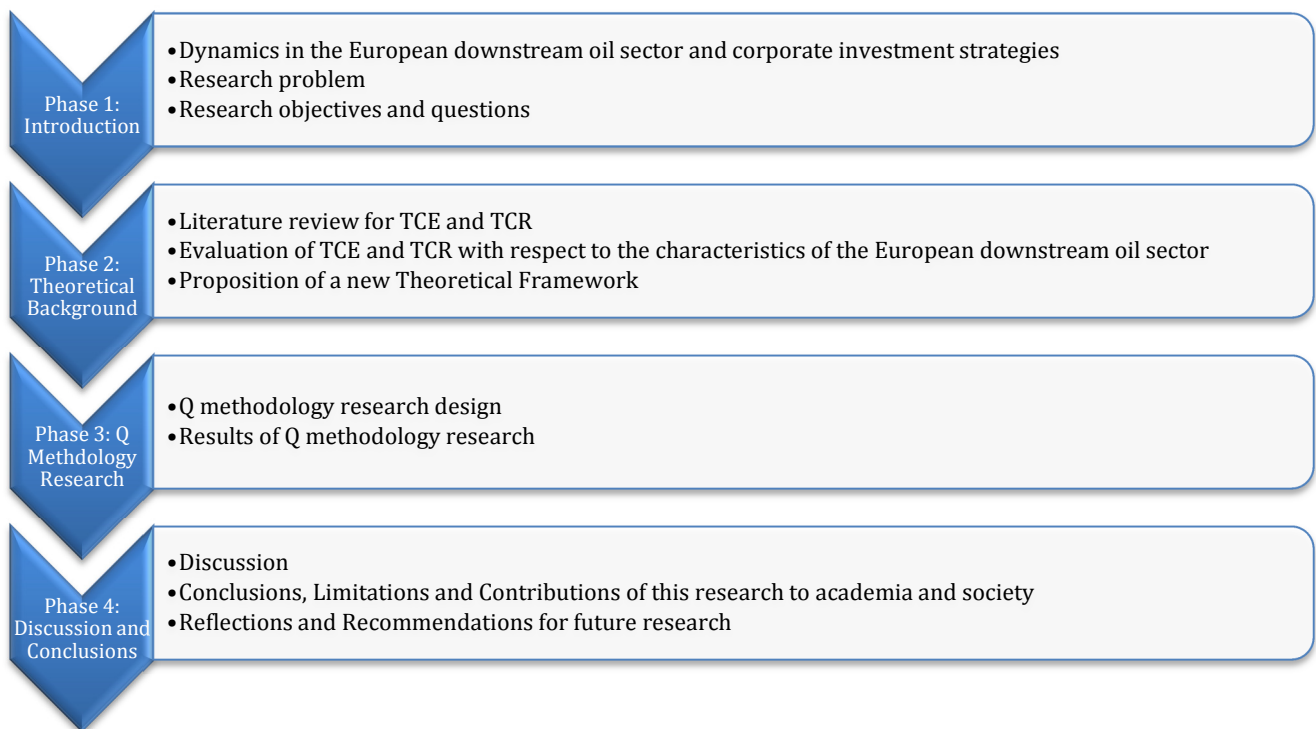


**Figure 1: The four phases of the research approach.**

### ***Phase 3: Q methodology research***

This phase is concerned with the more “practical” tasks of this research, as the focus is on designing and conducting a Q methodology research. At first, there is a description of the Q methodology research design, where the necessary steps to be taken are referred to and discussed. A detailed presentation of the choices made from the author of this thesis reveals how the Q methodology research was performed and how the data were processed. What follows then naturally is a presentation of the Q methodology research results, which are accompanied by comments wherever necessary. Conducting this type of research deemed to be necessary for “testing” in practice the drivers for investments or divestments that could be found in the literature.

### ***Phase 4: Discussion and conclusions***

This phase involves discussion and analysis of the results of the Q methodology research. There is a debate about the different perspectives of stakeholders in the sector and it becomes possible to reveal any areas of consensus or disagreement between them. Furthermore, the most important drivers for investments or divestments are emphasized, which helps answering the main research question of this thesis research. Moreover, the TCE/TCR theoretical framework developed in Phase 2 is evaluated, which helps to reassure its adequacy and ensure that the first research sub-question is answered sufficiently. Subsequently, the conclusions of this research are presented along with its limitations, and these are followed by its main contributions to science and practice. The last part of Phase 4 includes a personal reflection of the author of this report about the research process and the decisions made, accompanied by certain recommendations for future research.

## 1.6 Why Transaction Cost Economics?

It was discussed in the previous paragraphs that in the effort to describe the nature of the European downstream oil sector, the TCE and TCR theories will be employed and integrated, as they are perceived as very suitable for depicting the specific characteristics of this industry. However, this does not mean that these theories are the only available ones that could serve the same purpose. After all, TCE has its limitations and it is not by coincidence that numerous scholars have attempted to compare TCE or complement it with other theoretical frameworks, such as, for example, the resource-based and/or the real options theories (Chen & Chen, 2003); (Leiblein, 2003); (Mayer & Salomon, 2006). It is not within the scope of this thesis to compare the different theoretical perspectives and declare one of them (TCE) superior to the others. Nevertheless, the choice to base the analysis mainly on the TCE theory has been largely made due to the acknowledgement of the “market imperfections” of this sector.

Indeed, other theoretical frameworks have been successfully used to describe the dynamics in the European refining sector and the pressures it faces. A good example is the use of the famous Porter’s five forces theory (1979) in the work of Meijknecht, Correljé, & van Holk (2012). Certainly, many of the specific attributes of the European downstream oil sector could also be described using the five competitive forces namely: market rivalry, threat of substitutes, threat of potential entrants and the bargaining power of suppliers and of customers. So, for example, issues related to the bio-fuels mandates of the EC could be connected to the threat of substitution the European oil refining sector faces, or issues related to the competition European refiners face from the US, Russia and Asia could be connected to the threat of potential entrants in the European oil products market. There are numerous examples that can be given and it would not be difficult for someone to reach the conclusion that Porter’s theory can describe the nature of the European downstream oil sector adequately. However, as Meijknecht, Correljé, & van Holk (2012) have indicated, this is not really the case. The author of this thesis also agrees that Porter’s five forces is not the most suitable theoretical framework to be used for describing the European downstream oil sector. The reason for this has to do with the assumptions which accompany Porter’s theory.

The five forces theory is related to the Neoclassical Economics (NCE) theory, where some important underlying assumptions are that there are no information asymmetries and bounded rationality of decision makers. Therefore, there will be no uncertainty about prices, product characteristics or the behavior of competitors or trading partners. Moreover, in NCE is assumed that there is homogeneity of products without quality variations and transactions occur in a frictionless environment with multiple buyers and suppliers (Hobbs, 1996); (Al-Obaidan & Scully, 1993). In these cases the market is perceived to be quite competitive, with firms unable to possess market power. In practice, this means that transactions of firms can be conducted more efficiently in the market and vertical integration (hierarchical governance structure) would not offer any advantage. As a matter of fact, NCE considers firms merely as a production function, something like a “black box” which simply turns inputs into outputs and there is no adequate explanation about the reasons of their existence and growth (Hobbs, 1996); (Rindfleisch & Heide, 1997).

However, as it will be highlighted in Chapter 3, these assumptions of NCE and thus Porter’s five forces model, constitute them unsuitable for describing adequately the European downstream oil sector. The main reason is that the sector is characterized by information asymmetries, bounded rationality of actors and increased uncertainty, which reveals the need to look at the sector from a different perspective. This is the perspective of New Institutional Economics (NIE), which relaxes the assumptions of NCE. Moreover, whereas NCE do not consider any transaction costs, NIE recognizes

their existence and more importantly, it proposes the firm as an alternative way of organizing economic exchanges. Therefore in NIE and hence in TCE, firm is not a “black box” but it is along with the market, the two main governance structures that help to execute transactions. When costs of executing these transactions are too high, the preferred form of governance is the firm (hierarchy) which can be realized through vertical integration (Hobbs, 1996); (Rindfleisch & Heide, 1997); (Grover & Malhotra, 2003). Paragraph [3.3.12](#) discusses about the preferred forms of governance in the European downstream oil sector. It also highlights the reasons firms decide to vertically integrate and disintegrate according to market conditions. The fact that indeed firms are constantly opting for preferred forms of governance, comes to verify the conviction of the thesis author that TCE is indeed a very suitable starting point for analyzing the European downstream oil sector.

## 1.7 Q Methodology research: Why and How?

At this point is it important to mention the reasons that led the author of this thesis to choose Q methodology for this project and also how this research technique works.

The different ways (investments or divestments) that various types of companies follow in response to the dynamics in the sector, indicate that people in these companies perceive these dynamics in different ways. Furthermore, their perceptions are very important because in the end, the people in these companies are the ones taking decisions to invest or divest in the European downstream oil sector, and the impact of their decisions can really affect the competitiveness of this sector. Of great importance is also what people collaborating with these companies (e.g. from public agencies, research institutes etc.), think is driving corporate investments or divestments. These people also affect the sector via policy making or consultancy. According to Watts & Stenner (2012), in cases where there is a need for researching an issue where it *does matter* what people think about it, then this creates a friendly situation for employing Q methodology. As the same authors emphasize, a generic rationale for opting for Q methodology requires that “people’s viewpoints are established as being of considerable importance relative to a particular subject matter” (p. 175). This is also believed to be the case with this research, therefore choosing to use Q methodology seems to be a reasonable choice.

Moreover, Q methodology is a research technique particularly suitable for exploratory research where the focus is on identifying the different perceptions of participants about an issue at stake. The main characteristic of this research technique is that it combines qualitative and quantitative research characteristics, in a way to study human subjectivity about a topic (Ellis, Barry, & Robinson, 2007) or more specifically, the “viewpoints or discourse of people concerning a specific theme” (Frantzi, Carter, & Lovett, 2009, p. 179). The essential strengths of Q methodology according to Dryzek & Bereijkian (1993, p. 50) are that it is “explicit, publicly constrained by statistical results, and replicable in its reconstructions and measurement of subjects”. Therefore, Q methodology has specific strengths which indicate it is of good use for the purposes of this thesis research. This is because there is a need to explore diversity among perceptions of stakeholders in the European downstream oil sector, about what is driving corporate investments in this business.

Another issue is that Q methodology is not concerned with the concepts of reliability and validity, as these are understood in other research methodologies. Q methodology is valid because it delivers what it claims to deliver; the different viewpoints of participants about a particular topic. Moreover, Q methodology research is not attempting to generalize its results for a wider population, than for the sample employed in the research. It aims more to explore the diversity among their perceptions, and

the fact that usually the sample for a Q methodology research consists of experts or specialists about the topic under consideration, it does not allow for a generalization of the results to a wider population (Watts & Stenner, 2012). In the case of this research this poses no problem as the effort is on exploring the perceptions of people who are knowledgeable about the topic (the stakeholders).

Last but not least, it should be mentioned that a characteristic of Q methodology is that it doesn't require a large number of participants to produce statistically valid results (Frantzi, Carter, & Lovett, 2009); (Ellis, Barry, & Robinson, 2007); (Watts & Stenner, 2012) and it can minimize the research bias due to the way the statements to be used in the research are generated (Barry & Proops, 1999); (Frantzi, Carter, & Lovett, 2009). This is also one more reason why Q methodology is chosen. Since the research is part of a master thesis project, there are limited resources and time constraints. Thus, it is not so easy to identify a large number of participants knowledgeable about the topic and conduct Q&A interviews with them or assign them with questionnaires. That would be a serious problem if a typical survey would be employed for this research, as a limited number of participants can significantly affect the results in a negative way. On the contrary, Q methodology is employed, where even a small sample size is enough, as long as no random sampling is employed but purposive sampling instead (Cuppen, Breukers, Hisschemöller, & Bergsma, 2010). Therefore, this technique is believed to be particularly suitable for the purposes of this research.

Concerning the execution of a Q methodology research, six distinct steps are included. They have been described by numerous researchers (Cuppen, Breukers, Hisschemöller, & Bergsma, 2010); (Watts & Stenner, 2012); (Frantzi, Carter, & Lovett, 2009); (Ellis, Barry, & Robinson, 2007); (Barry & Proops, 1999); (Davies & Hodge, 2007); (Dryzek & Berejikian, 1993). Phase 3 includes the first five steps and Phase 4 the last one (see [Research Approach](#)). A brief description of every step follows below:

**1<sup>st</sup> step:** Define the concourse, meaning identify all the discourses about a particular topic to be investigated. In the case of the proposed thesis research, the concourse consists of all opinions, statements and ideas related to the reasons firms decide to invest or divest in the European downstream oil sector.

**2<sup>nd</sup> step:** A set of items (statements) is derived from the concourse with structured interviews or with literature review (apart from academic literature, newspapers, magazines, relevant conference proceedings etc. can be used) or both. It is important that the researcher is not generating his or her own items and that the items wording should be as close as possible to the original wording, as it was found in the concourse. The set of items should then be reduced to a manageable number, namely the Q set, without neglecting to include in this set, items representing the whole spectrum of opinions and perspectives that were identified. In the case of this research, the items of the Q set are referring to drivers for investments or divestments in the European downstream oil sector, as these can be identified in an extensive literature review.

**3<sup>rd</sup> step:** The next step is to identify the P sample, which is the name for the sample of participants-respondents in the research. In the case of this research, purposive sampling was preferred in order to include participants with a rather diverse point of view with respect to the topic. Hence, there was an effort to include in the sample, not only participants related to all types of oil companies (IOCs, NOCs, independent refiners etc.), but also people related to trading/terminal-operation companies, the European Commission, the Dutch National Government, research institutes, oil industry associations, consultancy firms etc.

**4<sup>th</sup> step:** In the fourth step, the respondents are requested to rank the items of the Q set, under a scale that represents agreement or disagreement, with phrases such as “most strongly agree” or “most strongly disagree” or with numbers (for example +5 = most strongly agree and -5 = most strongly disagree) used. The respondents are then forming the so-called Q sort, which is usually normally distributed. In order to allow for the Q sorting, the items are printed on small cards and the respondents are instructed to place the cards according to a forced normal distribution under the agreement and disagreement scale. Moreover, there is in general a short post-sorting interview with the respondents, where they are asked to explain their sort and to mention any other comments they have (e.g. an important item missing from the Q set). The contents of these interviews are then used by the researcher for the interpretation of the research results. A typical Q sort distribution is illustrated in the following figure and more details about the Q sort distribution used in this research are presented in Chapter 4.

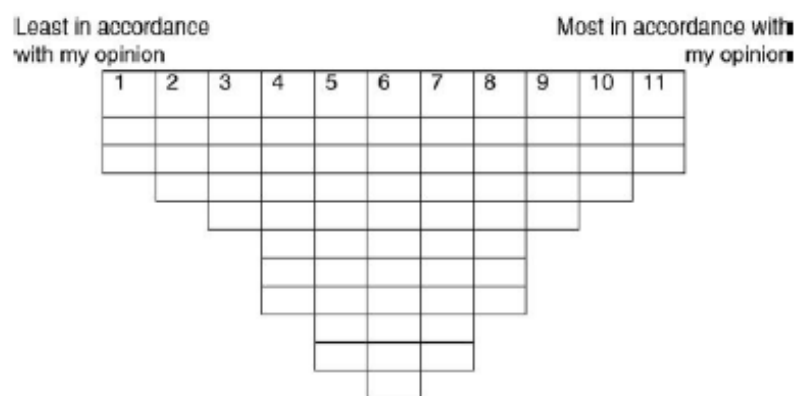


**Figure 2: A typical Q sort distribution.**

**(Cuppen, Breukers, Hisschemöller, & Bergsma, 2010)**

**5<sup>th</sup> step:** After all the Q sorts are formed, their data are used for a statistical analysis (the Q sorts are factor analyzed). This leads to the generation of a few “typical” Q sorts. These typical Q sorts are actually clusters of the original Q sorts which were very similar between them in terms of rankings of the items. There are dedicated software tools for processing the data and generating the typical Q sorts (conducting the factor analysis), such as the PQMethod (Schmolck, 2014) which was used in the case of this research. The statistical analysis conducted from the software generates several tables with results, containing a serious amount of information to be analyzed.

**6<sup>th</sup> step:** The final step is to consider the typical Q sorts as different perspectives and conduct an analysis of the data. This analysis is focusing first on the items that received the highest support or rejection from the respondents, but also on the items that distinguish the “typical” Q sorts between them. It depends of course on the researcher how the results will be interpreted and analyzed. In Chapter 5 there is a detailed analysis and discussion about the results of this research.

At this point, an overview of the main characteristics of this research has been given. What follows is a description of how this report is structured.

## 1.8 Report structure

This thesis report consists of nine main Chapters:

### *Chapter 1*

In this Chapter there is an introduction to the thesis topic and the key research elements are presented, such as the research objectives, the research questions, the research approach, and the basic rationale for using the TCE theory and the Q methodology technique, along with what should be expected to result from this research.

### *Chapter 2*

This Chapter introduces the current dynamics in the European downstream oil sector. This is followed by a detailed analysis of how different firms involved in this sector react to these dynamics, something demonstrated through their investment strategies. It is discussed that there are several contradictory trends with the respect to investments or divestments in downstream assets in Europe, and firms of different size and scope have different rationales and perceptions about investment opportunities in the region.

### *Chapter 3*

Here is where theory comes into the picture. First, there is a detailed description of the main assumptions and constructs offered by TCE. This is accompanied by a critical evaluation of these constructs assessing their suitability for describing the characteristics of the European downstream oil sector. Next, there is identification of the limitations of TCE when it comes to apply this theory in the context of the sector. The analysis of these limitations pinpoints the need to introduce TCR as a complementary theory to TCE, in order to overcome the short-comings of the latter theory. After a detailed presentation of the key constructs of TCR, there is again an assessment of their suitability for the purposed of this research. In the end, a new theoretical framework is proposed, combining elements from both TCE and TCR. This constitutes also the preliminary answer to the first research sub-question.

### *Chapter 4*

This Chapter emphasizes the way the Q methodology research was designed and executed. There is a detailed presentation of how the Q set for this research was formulated, and particular attention is paid on how the theory has contributed in this process. The Q set contains items which highlight the most important drivers for investment or divestments that could be identified in the literature. This helps to answer the second research sub-question of this study. Then the focus shifts on how the P sample was identified and on which was the procedure for conducting the interview sessions with the participants. Last but not least, there is an introduction to the statistical concepts of Q methodology for results extraction and an analysis of how the results of this research were generated.

### *Chapter 5*

The vast majority of the results of the Q methodology research is presented in this Chapter. Initially, there is discussion about the extracted Factors which represent “ideal” viewpoints of participants with respect to what is driving corporate investments or divestments in the European downstream oil sector. Subsequently, the areas of consensus and disagreement between the participants’ opinions are emphasized. Eventually, an extensive discussion follows to deliver in-depth insights into how the different stakeholders perceive each one of the investment/divestment drivers represented in the Q set. Other qualitative information extracted from the interviews with the participants is revealed and used

in this discussion, which offers a comprehensive overview of the diversity among perceptions. This helps to answer the third research sub-question of the study. In the end, after having the stakeholders “evaluating” the Q set-drivers originating from the literature, it is possible to collect and present the most important drivers for investments and divestments in the sector and answer the main research question of this master thesis project. Last but not least, the results of the Q methodology research help to test the explanatory power of the TCE/TCR theoretical framework proposed in Chapter 3, and extract useful conclusions about its applicability and usefulness. In this way, a definitive answer is given to the first research sub-question.

### *Chapter 6*

The concluding remarks of this research are presented in this Chapter. These are accompanied by the limitations of this work but also its contributions to the academic world and to society.

### *Chapter 7*

At this point there is an evaluation of the major research execution choices made during this study. There is critical reflection of what worked as expected, what not and which are the lessons learned.

### *Chapters 8 and 9*

These last two Chapters are concerned, respectively, with future research propositions made by the author of this thesis and with information about the bibliography used for this research.

## 2. Dynamics in the European downstream oil sector and corporate investment strategies

A detailed description of the current dynamics in the European downstream oil sector, and particularly the refining sector, is presented in Appendix A. This analysis and information provided at this part of the report offer the reader a comprehensive overview about the trends in the sector. However, for report-length constraints, there is only a very brief presentation of these dynamics in this Chapter. On the contrary, since this research is mainly focusing on how companies react to these dynamics in terms of investments, more attention will be paid in this Chapter to the different strategies of firms involved in the downstream oil business in Europe.

### 2.1 Remarks about the dynamics in the sector

The European refining sector has been and still faces a multitude of pressures and challenges. To start with, the reality is that almost all European refineries have been built in the 60s and 70s, when demand for oil products in the region was high. Moreover, the majority of them had and still has a product slate dominated by gasoline, because this was the most-demanded fuel in the market for years. However, since a few years, the market environment has changed and the whole sector is put under pressure by a variety of developments.

At first, there has been observed a falling demand for oil products (-13%) in Europe and particularly the one for gasoline (-20%) over the period 2008-2013 (FuelsEurope, 2014).

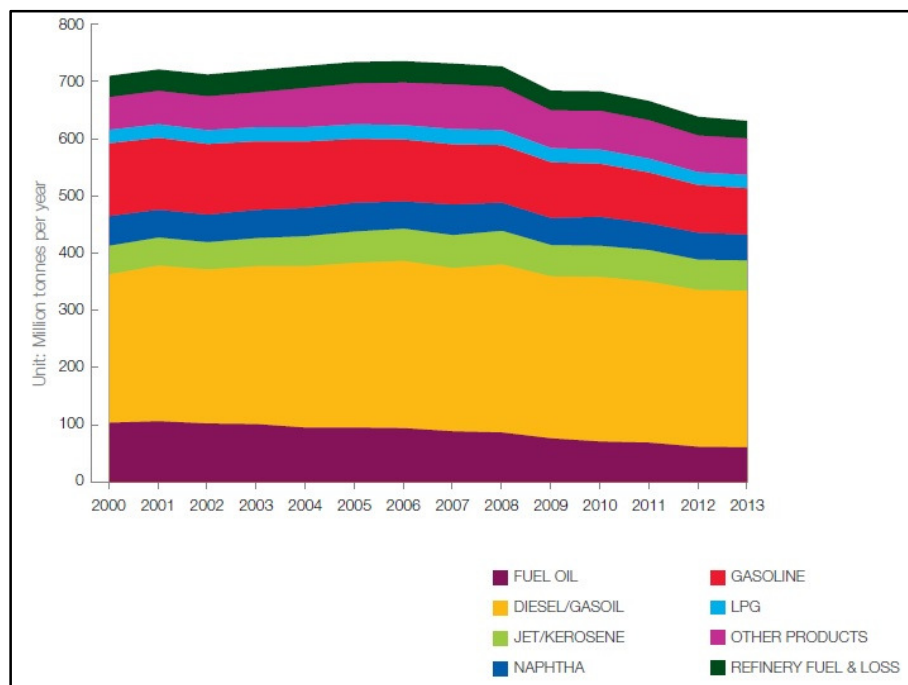


Figure 3: Demand history of oil products in the EU.

(FuelsEurope, 2014); (Based on data from Wood Mackenzie)

The reasons behind the declining demand are the reduced economic activity in many European countries due to the financial crisis, the more efficient use of oil products or the substitution effects by, for example, bio-fuels (FuelsEurope, 2013), the higher efficiency of new diesel and gasoline car engines (Cuthbert, Leavens, Kennaby, & Birch, 2011), as well as the increasing use of electricity in the transport sector due to the environmental legislation of EC. The declining demand has had a tremendous impact on the profitability of European refineries. Largely being gasoline-heavy, refineries experienced a great loss of market share. Next to this, demand patterns have changed as middle distillates and, particularly, diesel are now called for by the market. This was largely the result of tax incentives provided in many European Union (EU) member states, supporting the use of diesel instead of gasoline as a road fuel (FuelsEurope, 2014). This meant that European refiners have had to undertake upgrading investments in their plants in order to minimize the production of gasoline in favor of diesel. However, such investments are very capital-intensive and with long lead-times, and not many refineries were profitable enough to realize them. In the end, the gasoline-heavy refineries could not supply adequate volumes of middle distillates to meet the demand. This has led to a European market where there is a misbalance between supply and demand for oil products, as middle distillates are in deficit and gasoline in surplus. Inevitably, Europe has become more dependent on imports for middle distillates, whereas the abundance of gasoline has been keeping its price low, pushing downwards the profitability of gasoline-heavy refineries.

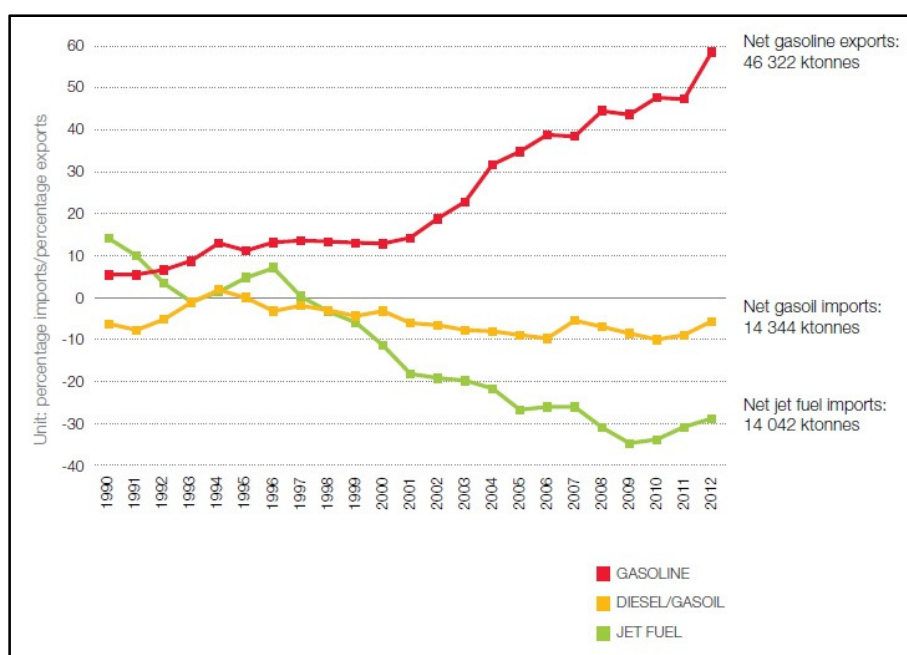


**Figure 4: Net trade flows for refined products.**

**(FuelsEurope, 2014); (Based on data from Eurostat)**

On top of the previous, these gasoline-heavy refineries have been exporting for many years their gasoline surplus to the US (KPMG, 2012); (FuelsEurope, 2014). This is not feasible anymore for various reasons. First, the US domestic demand for gasoline also decreased during the recent years, especially since 2006 (KPMG, 2012), as a result of increasing volumes of US-made bio-fuels (primarily ethanol) blended into the gasoline pool. Other contributing factors have been the increasing fuel efficiency of car engines, the increasing adoption of diesel-motor vehicles, and the continued upgrading of US refineries

with catalytic crackers enabling them to produce more gasoline (Meijknecht, Correljé, & van Holk, 2012). An important reason has also been the new heavy crude production from Canadian oil sands and the shale oil and gas revolution, which has led to cheaper feedstocks and energy costs for US refiners. This in turn increased their cost-competitiveness and gave them the ability to supply their domestic market with more gasoline at lower prices, thus undermining Europe's gasoline exports. (IEA, 2013b); (FuelsEurope, 2014). European refineries were eventually left with no obvious market to ship their production.

However this is only a small part of the picture. European refineries also face thin and even eroding refining margins, particularly the plants unable to shift their production towards more middle distillates (Bosoni & IEA, 2014). Operating costs are very high, especially because of the high energy costs in Europe (IEA, 2013a); (Nelson & CONCAWE, 2013) and this is accompanied by the higher feedstock prices refineries have to pay. The latter is largely the result of the decreasing production of light-sweet crude oil from North Sea fields (Cooper, S. & Wood Mackenzie, 2013). Many European refineries are built to process this type of crude quality. Therefore there is increased demand for it in the market but not enough supply, which means that it is being traded at a premium. Other heavier and sourer blends are more abundant in the market but in order to process them, a refinery needs to proceed to serious investments which are difficult under the current situation in the market (Meijknecht, Correljé, & van Holk, 2012). Furthermore, the falling demand for oil fuels in Europe has resulted in substantial refining overcapacity in the region, coupled with low crude runs, which are again leading to thin refining margins and therefore decrease the profitability of European refineries (FuelsEurope, 2014).

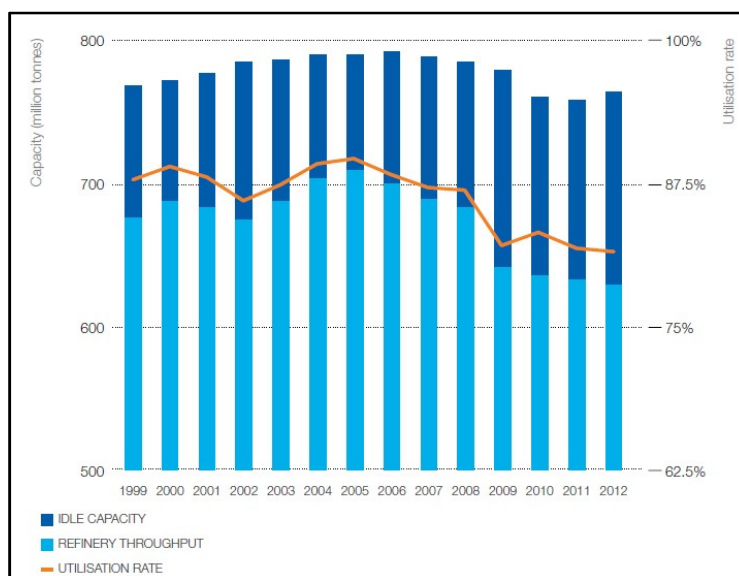


**Figure 5: Capacity and utilization of European refineries.**

**(FuelsEurope, 2014); (Based on data from BP Statistical Review of World Energy 2013)**

On top of the aforementioned comes the heavy burden for European refineries due to the environmental legislation of the EC. The policies aiming to reduce the use of fossil fuels in the transport sector (e.g. by increasing the share of bio-fuels in the fuel mix), have all contributed to the declining demand for oil products in Europe. Furthermore, there are also the issues of the quality of fuels

produced (sulphur content) and the allowed CO<sub>2</sub> emissions of refineries, and all this legislation is adding more to the costs European refineries have to pay (Beddoes & EUROPIA, 2013); (FuelsEurope, 2013).

Next to these pressures, competition is becoming fiercer from the US, Russia, Middle East and Asia, not only in the European arena, but also in other traditional European export markets such as Africa and Latin America. Not only these competitors are avoiding the legislative burden Europe's refiners face, but they are able to obtain other competitive advantages. For example US refiners benefit from technological developments such as the shale oil and gas revolution, which offer them low energy and feedstock costs. Middle Eastern refiners benefit from their large-scale and state-of-the-art facilities, along with other locational advantages such as access to cheap crude oil feedstocks and strong governmental support, advantages which Russian refiners also enjoy. Last but not least, both Middle Eastern and Asian refiners have the advantage of increasing demand for oil products in their fast-growing domestic markets (Meijknecht, Correljé, & van Holk, 2012); (Oil and Energy Trends, 2014); (Oil and Energy Trends, 2013); (Cuthbert, Leavens, Kennaby, & Birch, 2011); (Fattouh & Mallinson, 2013); (IEA, 2013b).

All the considerations are translated to a need for European refineries to invest more in upgrading and desulphurization units. This would enable them to meet the increased domestic demand for diesel and other middle distillates, remove the burden of having a gasoline surplus with no available market to sell it to and provide Europe with high quality fuels meeting the stringent EU specifications. In this case, their refining margins would be improved and they would be better prepared to compete with their counterparts outside Europe, in both European and global markets. On the other hand, these investments require large capital expenditure and long lead times, in a market which is mature and with declining demand for oil-based fuels, which is characterized by refining overcapacity, tight and volatile refining margins and increased operation and particularly, energy costs. Moreover, the need to comply with the EU regulations requires investments which are only allowing refineries to remain in the business, without offering any serious return.

All of these considerations make investment decisions a difficult task for many European refiners. Old and simple plants, of a small scale and in land-locked locations are likely to shut down due to the region's overcapacity. Although, according to the IEA (IEA, 2013b); (Bosoni & IEA, 2013); (Bosoni & IEA, 2014) 15 refineries have been closed from 2007 to 2013 in OECD Europe of a total capacity of 1.7 mb/d and another 110 kb/d of capacity are expected to close in 2014, demand fell almost 1.9 mb/d during the same time frame, forcing the utilization rates to remain low or to drop even further. Overcapacity therefore remains and further refinery closures are inevitable. These closures will occur in favor of more complex and larger refineries, in locations with good logistics infrastructure and access to open seas, which are more likely to attract investments and survive. Indeed, some European refiners are investing in their plants in order to not only stay in the business, but also to decrease the competitiveness gap with their competitors worldwide. However, other refiners are choosing to put their underperforming assets for sale or to convert their plants to storage facilities and/or terminals. There are also many cases of refiners who have decided to shut down their refineries and/or exit the refining business in Europe. On the other hand, new entrants are observed in the European refining sector. They proceed to acquisitions of distressed assets and upgrading investments. It is also noteworthy that many trading firms which have no background in refining are entering in the refining business in Europe.

There are thus, different perceptions of the dynamics and developments in the European refining sector and whereas some oil companies consider closures or sales of their plants, and in some cases their transformation to storage facilities, other players invest in asset acquisitions or in upgrading units. The different strategies of oil companies involved in this business in Europe, as well as how and why trading companies are increasingly becoming key players in this industry, are the topics of discussion in the following paragraphs.

## 2.2 Corporate investment strategies in the European downstream oil sector

In order to analyze the changing ownership patterns of European refineries and the different investments strategies of firms involved in the oil refining and trading business in Europe, it would be wise to group the firms according to their characteristics. For the purposes of this research, the author of this thesis will adopt the categorization proposed by Meijknecht et al. (2012), which includes the following five categories:

1. **International Oil Companies (IOCs)**; these are the partly or wholly vertically integrated oil companies with an international presence, such as ExxonMobil, Royal Dutch Shell, BP, Total and Chevron.
2. **National Oil Companies (NOCs) of producer countries**; these are companies from crude oil producing countries which are significantly involved in upstream operations but they have reduced presence in the downstream (refining and sales) business on an international level.
3. Incumbent oil Companies or “**National Champions**”; these are formerly state-owned oil companies in Europe and emerging markets, such as India and China. The former are usually dependent on crude oil imports, have a strong downstream presence in their domestic markets and loose ties with their home governments. The latter also have a very significant downstream presence in their home markets, but they may be state-controlled or may be enjoying strong governmental support.
4. **Independent Refiners**; these are companies involved only in the refining segment of the oil value chain, with only some exceptions of independent refiners owning marketing or retail outlets. These companies are not involved in upstream operations.
5. **Others**; the companies in this category can be clustered three other subgroups, namely the (a) niche refiners who operate small refineries producing certain oil products such as asphalt and bitumen, the (b) conglomerates and marketers who own and operate refineries either because they are interested to exploit arbitrage opportunities across the refining and transport (of both crude and oil products) segments of the oil value chain or because they target to become more integrated upstream on the oil value chain and finally, the (c) private equity funds which are adding refineries at low prices to their assets portfolio, because they perceive a financial opportunity. The second group of companies will receive significantly more attention in the following paragraphs, as it will be revealed that trading companies have been significantly increasing their presence in the refining business in Europe over the past years.

An important remark here is that there are oil companies, like for example Total and Lukoil, which many not fall under only one category. Nevertheless, these are usually exceptions and most of the companies involved in the European refining sector fall under one category. The aforementioned groups of companies are helpful in giving a better overview of how firms with similar characteristics react similarly to the dynamics of the downstream oil business in Europe.

### 2.2.1 International Oil Companies (IOCs)

The IOCs' strategies have been characterized by an effort for consolidation and rationalization of their refining capacity in Europe over the past years. As a matter of fact, IOCs sold or tried to sell almost 1,897 kb/d of refining capacity in Europe from 2008 to 2012, alongside with 601 kb/d of refining capacity which has been idled over the same period. Most of the refineries which have been closed, sold or idled were simple refineries of a small scale, and in general, IOCs have been trying to consolidate their presence in the European refining sector towards their large-scale, complex, integrated refineries, located close to major logistics hubs and markets, such as the Amsterdam-Rotterdam-Antwerp region (Meijknecht, Correljé, & van Holk, 2012). So for example, even though companies such as ExxonMobil and Royal Dutch Shell have been divesting their non-core refining assets, they both maintain large-scale refineries integrated with petrochemicals, in their portfolio. Almost all of the IOCs have reduced their refining capacity over the past years, often not only in Europe but also on a global scale. It seems in general that the commitment of IOCs to integration has been gradually decreasing over the past years and there are some reasons behind this trend (Ernst & Young, 2012a).

To start with, due to the generally higher crude oil prices over the past years and the thin refining margins, the IOCs have seen higher returns from their operations upstream than the ones downstream. The higher margins upstream have provided a strong motive for many IOCs to focus on these operations and invest more for exploration and production, and at the same time shed a part of their refining capacity especially in mature markets such as Europe (Cuthbert, Leavens, Kennaby, & Birch, 2011); (Ernst & Young, 2012a); (Meijknecht, Correljé, & van Holk, 2012); (Oil and Energy Trends, 2013). The IOCs are forced to spend increasing amounts of capital for exploration and production purposes, and this capital can be redirected from less profitable activities such as refining (Cuthbert, Leavens, Kennaby, & Birch, 2011). This is especially the case in Europe where, because of the overcapacity, of the decreasing demand for oil products and especially gasoline, as well as of the increasing environmental legislative burden, the refining margins are decreasing and many plants are underperforming or making losses. Moreover, it is noteworthy that the trend of asset divestments in the European refining sector by the IOCs occurs despite of their increased financial strength, which normally should allow them to proceed to upgrading investments in order to maximize the performance of their unprofitable refineries (Meijknecht, Correljé, & van Holk, 2012).

However, the focus on IOCs is not limited to their more profitable upstream business, but they also ensure a downstream presence in growth markets, such as non-OECD and especially Asian markets. What enables them to proceed with this strategy is their global geographical spread, their level of vertical integration, and the ability to use financial resources generated from different segments of their business, in order to invest in other segments of the oil value chain. Thus, for IOCs, divesting non-essential refining assets in mature markets like Europe, provides them with the necessary capital outlets for investing either in their upstream operations or in their downstream operations in other regions of the world (Cuthbert, Leavens, Kennaby, & Birch, 2011); (Meijknecht, Correljé, & van Holk, 2012); (Ernst & Young, 2012a).

The divestment trend discussed previously is the rule. There are of course exceptions where IOCs have invested or announced investments in their core refineries in Europe. The most recent example by the time this report was being prepared was the announcement from ExxonMobil of a \$1 billion investment in its Antwerp refinery, including mainly the installation of a coking unit which would enable the plant to convert heavy, high-sulphur residual oil into high value products such as diesel. This investment decision came despite the tough environment for refineries in Europe (Williams & Stiff, 2014).

### 2.2.2 National Oil Companies (NOCs) of producer countries

Typical examples of NOCs from oil exporting countries are Rosneft, Kuwait Petroleum Company and Gazprom. These types of companies maintained a total capacity of 1,416 kb/d in 2012 in Europe, accounting for only 10% of total European refining capacity. Thus their presence in Europe has not been substantial and as a matter of fact, NOCs invested in and divested approximately the same amount of refining capacity in Europe, over the period 2008-2011 (Meijknecht, Correljé, & van Holk, 2012).



Figure 6: Restructuring of European refineries owned by producer NOCs (2008-2011).

(Meijknecht, Correljé, & van Holk, 2012); (Based on an analysis of the Clingendael International Energy Program and on data from Purvin & Gurtz and various newspapers)

The relatively small presence of NOCs in the European refining sector is a result of the increased demand for oil products and the attractive refining margins in their domestic markets, since the early 2000s. This was especially the case in the Middle East. These developments made Middle Eastern NOCs to reconsider their previous strategy (since the 70s-80s) which aimed, through investments in refining and marketing assets abroad, like for example in Europe, to secure outlets in consuming countries. After 2000, these NOCs started focusing more on securing enough capacity in their home market to meet the increased domestic demand (Fattouh & Mallinson, 2013); (Meijknecht, Correljé, & van Holk, 2012). This is a major reason for the construction and commissioning of the state-of-the-art mega-refineries in the Middle East, many of which are also export oriented. However, in the case of Russian NOCs, some purchases of refineries in Europe may still be linked to a desire to secure outlets for their crude oil production or to diversify their income away from their home country (Cuthbert, Leavens, Kennaby, & Birch, 2011); (Oil and Energy Trends, 2013).

It can be concluded that in principle NOCs from crude oil producing countries are not considered to be market players planning to get seriously involved in the refining business in Europe. Besides their commitment to serve their local market, these NOCs are more likely to keep investing in the downstream industry of many Asian countries, such as China, which are major importers of their crude oil and refined products outlets. Their low interest for the European refining sector is even more highlighted by the fact that, when these NOCs have proceeded with any investments (mainly acquisitions) related to refining assets in Europe, they did so for specific strategic considerations, such as diversification of their investments portfolio, and not because of a desire to have presence in the

European refining sector as such (Meijknecht, Correljé, & van Holk, 2012). A good example may be Rosneft which in 2011 gained ownership of 240 kb/d of refining capacity in Germany through a joint venture (Ruhroel JV) with BP, and in 2013, it also acquired 21% of the shares of Saras SPA which operates the 300 kb/d Sarroch refinery in Sardinia, Italy (IEA, 2013b). Despite of these acquisitions, Rosneft's executives stated in September 2013 that further expansion in the European refining sector is not part of the company's strategy at the moment (Elliot, 2013). Furthermore, there are also cases where crude oil producers may proceed with an acquisition of a refining asset in Europe, not because they want to process their crude oil at the plant, but because they may want access to sites to be used as storage and break-of-bulk points for crude oil cargoes (Oil and Energy Trends, 2013).

### 2.2.3 National Champions

There are two different types of National Champions, the ones originating from Europe and the ones from emerging markets such as India and China. The focus will first be on the European oil companies of this kind.

#### *National Champions from Europe*

These are the former state-companies especially in Southern and Eastern European countries, with a strong presence in the downstream sector of their domestic markets and with some ties with their national governments. Typical examples are companies like MOL (Hungary), ENI (Italy), REPSOL (Spain), OMV Group (Austria) etc. These companies were operating a total refining capacity of 4.6 mb/d in 2012 or in other words the 33% of the total refining capacity in Europe, making them the largest group of European refinery owners by type (Meijknecht, Correljé, & van Holk, 2012). According to the same authors, over the period 2008-2011, European National Champions acquired 78 kb/d of refining capacity, while they sold (or put for sale) 190 kb/d and idled or converted to storage almost 80 kb/d (based on data by Purvin & Gertz and an analysis made from the Clingendael International Energy Programme - CIEP).

As mentioned, European National Champions are in essence former National Oil Companies from Southern and Eastern Europe which have been largely privatized in recent years (Oil and Energy Trends, 2013). The privatizations mainly concerned the downstream assets of these companies and not their upstream assets (if any). However, their privatization exposed them to competition, which in turn forced them to start diversifying their business geographically, especially their upstream divisions. Typical examples of European National Champions with a strong international presence in upstream operations are Total and ENI. Other National Champions from Central and Eastern Europe have been however keeping their focus on these European regions (Meijknecht, Correljé, & van Holk, 2012). Nevertheless, when it comes to the downstream operations of European National Champions, all of them have remained committed to serving primarily their local market. These companies have retained a monopoly or majority interest in refining and marketing in their home country, as well as a large share of the retail and commercial fuels market (Cuthbert, Leavens, Kennaby, & Birch, 2011). Furthermore, the "national" character of these companies entails that they still have strong bonds with their national governments, while the latter seem to be still able to exercise a high degree of control, even with a minority share. This is often translated to pressures to maintain low-profitability assets in their portfolio at their home markets for political purposes, and in general, strategic decision making in

these companies takes into account the political role played by the companies themselves (Cuthbert, Leavens, Kennaby, & Birch, 2011); (Meijknecht, Correljé, & van Holk, 2012).

European National Champions have been operating, in general, simple refineries in Europe, compared to the more complex refineries operated by the IOCs (exception is MOL which possesses some very complex refineries in Hungary and Slovakia). The first reason for this is that some European National Champions have been experiencing financial difficulties to proceed with costly upgrading investments. The second reason is that these investments were not extremely urgent for these companies, compared, for example, to independent refiners. This is because National Champions have been mainly operating their simple refineries in their home countries where the significant entry barriers and their monopolistic power have protected them from international competition (Meijknecht, Correljé, & van Holk, 2012). Nevertheless, keeping non-complex refineries operational is not sustainable in the long run, even for these companies, taking into account the developments in the European refining sector which were described in previous paragraphs. Therefore, it was expected to see some of these National Champions investing in hydrocracking and other conversion units. Such examples are Portugal's Galp (a new 43 kb/d hydrocracker commissioned at beginning of 2013), Hellenic Petroleum (hydrocracker at Elefsinas refinery in Greece) and Total (hydrocracker at Gonfreville refinery in France). Coker units have also been installed in Greece and Spain (IEA, 2013b). OMV Petrom, a subsidiary of OMV Group, recently announced that it completed a €600 million modernization program for its Petrobazi refinery in Romania. The modernization was performed during two scheduled shutdowns between 2010 and 2014 and it has enabled the refinery to process a wider variety of crude oil feedstocks, it has increased the diesel-production capacity of the plant and it has improved the refinery's energy efficiency (Oil & Gas Journal, 2014). Nevertheless, many other National Champions will eventually have to do the same. If this will be unfeasible due to limited financial resources, it will mean that they will have to find alternative markets for their low value products such as gasoline or rationalize their refining capacity, especially when this capacity is located abroad. For example, MOL decided to shut down in 2014 its 55 kb/d Mantova refinery in Italy and moreover plans to convert the site into a terminal for the distribution of refined products (Oil and Energy Trends, 2014); (Elliot, 2013). OMV Group has been reported to follow a similar strategy to the one of IOCs, including divestments of downstream assets particularly in Europe (Preqin, 2013).

### *National Champions from emerging markets*

These are privately-owned companies from emerging economies which are enjoying strong governmental support. Characteristic examples include Lukoil (Russia), PetroChina (China) and Essar (India). This group of companies has been very active in acquisitions of stakes in several European refineries over the past years. It is worth mentioning that National Champions from emerging markets have acquired 1,064 mb/d of refining capacity in Europe, over the period 2008-2011 (Meijknecht, Correljé, & van Holk, 2012). Opposed to IOCs which have demonstrated a strategy of downstream disintegration especially in Europe, these National Champions are targeting to become more vertically integrated on an international level, something which has become part of the strategy of NOCs from producing countries as well (Ernst & Young, 2012a). Acquiring refining assets in Europe, enables these companies to become globally competitive, as they gain access to major oil markets and through integration they can capture more value along the oil supply chain. For some of these National Champions, investing in the European downstream oil sector is also perceived as a way to access technologies and enhance their "know-how", while for others it may also be a way to diversify their activities and reduce exposure to commodity price volatility (Ernst & Young, 2012b). Furthermore,

apart from acquiring refineries in Europe, these National Champions have been increasingly establishing alliances and other partnerships with existing shareholders of downstream assets in the region (IEA, 2013b); (Ernst & Young, 2012b).

A prominent example of a National Champion with a strong presence in Europe is Lukoil, which has stakes in four refineries (Bourgass, Ploiesti, Augusta and Vlissingen). According to Meijknecht et al. (2012), Lukoil has been expanding its presence in the European refining sector for mainly three reasons: first because in this way it can forward integrate and capture value from the downstream segment of the oil value chain in a major market like Europe (Lukoil is a major producer of Russian crude oil and a large share of it is being exported to Europe), second because by acquiring refineries (e.g. Vlissingen refinery) capable to process a variety of feedstocks such as Urals blend crude oil, straight-run fuel oil and vacuum gasoil, the company can expand its export markets, and third because acquiring refineries in Western Europe enables the company to reinforce its trading and retail position in Northwest Europe which is a major oil product market.

The Indian company Essar is another example of a National Champion from India. Essar does not share exactly the same characteristics with Lukoil, as it is a company focusing more on the downstream business and in this respect, becoming more vertically integrated is not a key issue of the company's strategy (Meijknecht, Correljé, & van Holk, 2012). The company proceeded in 2011 with the acquisition of Shell's 296 kb/d Stanlow refinery in Cheshire, England (Oil and Energy Trends, 2013), for a price of \$350 million. The refinery was providing in 2011 one sixth of the UK's gasoline, diesel and aviation fuel. Essar executives stated about the rationale behind their investment that with this refinery the company could gain access to an important market at a low price, as building a refinery from scratch would cost \$5 billion (Bounds, 2011). Other companies similar to Essar have probably acquired refineries in Europe for the same considerations, as many of these assets have been for sale at particularly low prices over the past years (Ernst & Young, 2012b). To return to the case of Stanlow refinery acquisition, Essar executives also justified their decision by stating that buying this plant would enable the company to ship in to Europe, crude oil refined from its Vadinar refinery in India, and they expressed their beliefs that the oversupply in the European market would end as smaller refineries had been already closing. Last but not least, within the plans of Essar was to invest in the refinery and enable it to process heavier (and cheaper) crudes, which in turn would increase margins for finished products (Bounds, 2011). It seems therefore that Essar's decision to invest in this refinery has been closely related to its strategy of becoming a major global oil product exporter, with strong support from Indian government (through favorable taxation rules for Vadinar refinery oil product exports) facilitating the execution of this strategy (Meijknecht, Correljé, & van Holk, 2012). Nevertheless, it is likely that Stanlow refinery is not considered to be a core asset for Essar, as the company will probably remain more focused on its domestic rapidly-growing market, where it enjoys more competitive advantages from its large scale and complex refineries. Therefore, it is probable that Essar's acquisition of Stanlow refinery serves as "a test to see whether physical assets in Europe can provide more market for its 'surplus' volumes of oil products from its refineries in India" (Meijknecht, Correljé, & van Holk, 2012, p. 73). The previous considerations seem to be confirmed from the fact that the company has been reported to have plans for reducing the plant capacity in 2014 (Bosoni & IEA, 2014) and even more so, has entered in the process of seeking potential buyers for selling the refinery, in order to reduce its debt and focus more on its core business in India (Crabtree, 2014).

Then is the case of PetroChina, which is a subsidiary of the Chinese National Petroleum Company (CNPC). PetroChina was one of the first of the National Champions to enter the European refining sector in 2011, with the acquisition of 50% of the shares of two refineries owned by INEOS, namely the

Grangemouth refinery in UK and the Lavera refinery in France (IEA, 2013b). The rationale behind these acquisitions has to do with the reported ambitions of the company to establish itself as a leading international energy company and to build a broad business platform in Europe (Cuthbert, Leavens, Kennaby, & Birch, 2011). The company aims to become more vertically integrated and exploit the benefits of entering into partnerships with other NOCs and IOCs, while it enjoys strong governmental support and abundant financial resources, advantages which the company makes use of (Meijknecht, Correljé, & van Holk, 2012). Nevertheless, the acquisitions of stakes at these two European refineries, may be connected to other drivers and other strategic considerations, and may not be fully related to the company's intention to integrate vertically and become more international. Such considerations may be related to gaining a foothold in the European market and gaining access to the significant expertise on petrochemicals of INEOS, one of the world's largest chemicals producers. Finally, a potential reason for acquiring a stake in the Grangemouth refinery can also be because it offers access to more information about oil price formation, as the plant is positioned in one of the largest global oil markets and it is the landing point for much of the North Sea oil fields production (Pfeifer & Blitz, 2011); (Meijknecht, Correljé, & van Holk, 2012).

To conclude about the National Champions from emerging economies, it seems that they are all expanding their downstream presence globally and of course being present in Europe is part of their plans. Their strategy is to become more international and in cases vertically integrated, in order to capture value from the downstream segment of the oil value chain, while all of them are enjoying strong governmental support (tax treatment, favorable regulations, cheap credit) in their home markets. This support also protects them from competitors. Nevertheless, since most of the competitive advantages of these National Champions are located back home and not in Europe, it is likely that their main business focus will remain there and that expansion in the European downstream oil sector is not considered a core business for them. It seems that this expansion does not happen mainly due to their globalization and integration ambitions, but instead it works more as a means to achieve specific-strategic goals, like gaining a foothold in the European region (Meijknecht, Correljé, & van Holk, 2012).

#### 2.2.4 Independent Refiners

This is the group of companies which focus almost exclusively on the refining business, as they source the crude oil they need and they sell their refined products in the open market. In some cases, independent refiners are also involved in retail and marketing operations, but these are usually exceptions. Of course, the previous mean that independent refiners are fully exposed to market dynamics and refining margins, for example related to demand for middle distillates, environmental legislation and changing crude oil qualities (Meijknecht, Correljé, & van Holk, 2012). Typical examples of independent refiners are companies like Valero, Preem, INEOS, Motor Oil (Hellas) etc.

Past years have seen significant changes in the positions of independent refiners and it is remarkable that from 2008 to the end of 2011, these companies idled or converted 49% of their total refining capacity. Divestments of refining capacity from independent refiners have been substantial after 2008, as a result of the thin refining margins and decreased profitability. In the beginning of 2012 independent refiners were operating a total capacity of 638 kb/d (Meijknecht, Correljé, & van Holk, 2012). However, this number decreased over the next years, following a major event; the bankruptcy of Petroplus, a Swiss-based independent refiner, in January 2012. The company had a portfolio of refineries in 2012 which were sold to new owners, many of them being trading companies as it will be discussed later on. The following refineries and storage facilities were sold: Antwerp IBR refinery

(Belgium, 110 kb/d), Cressier refinery (Switzerland, 68 kb/d), Ingolstadt refinery (Germany, 110 kb/d), Coryton refinery (UK, 220 kb/d) which was converted to a terminal in June 2012 by its buyers, and Teeside refinery (UK, 117 kb/d) which had been idled and converted to storage in 2009 by Petroplus itself (Ernst & Young, 2013); (Elliot, 2013); (IEA, 2013b). Concerning other assets of Petroplus in France, the Petit Couronne refinery (162 kb/d) was shut down in 2013 after the bids for its acquisition were rejected by a French court (Patel, 2013) and the Reichstett terminal (ex-refinery of 85 kb/d capacity which was closed in 2011 and was converted to a terminal) was acquired in 2013 by Rubis Terminal BV (ResearchViews, 2013).

It seems therefore that independent refiners have been decreasing the European refining capacity in their possession over the past years, in an effort to improve their balance sheets, which have been hit particularly hard by the dynamics in the European refining industry, and also to increase the utilization rates for the remaining (operational) refineries. Improving its financial position was also a main reason for INEOS to sell 50% ownership stakes for its two refineries in Grangemouth and Lavera to PetroChina (Meijknecht, Correljé, & van Holk, 2012). A notable exception to this trend of refining capacity rationalization in Europe from independent refiners was the acquisition of Chevron's 220 kb/d highly-complex Pembroke refinery by Valero in 2011, for \$730 million (Chevron, 2011). Nevertheless, Valero acquired the refinery with the target to supply with oil products the US and not the European market, since the company had closed its three refineries in the US East Coast over the previous years (Oil & Gas Journal, 2011). Moreover, Preem has been reported to have plans to upgrade its Gothenburg refinery by investing €33.6 million, in order to increase the capacity of the plant and double production of "renewable" diesel (diesel with one-third non-fossil content). The upgrading is expected to have been completed by autumn 2015 (Baltic Transport Journal, 2014).

To conclude about the independent refiners, their weaker financial capabilities compared to IOCs or NOCs, make them more vulnerable to fluctuations of the refining margins and business cycle in general. Since they are involved only in the refining business, they are particularly exposed to risks of low demand volumes and prices of oil products, and high feedstock costs, which can even lead them to insolvency, like in the case of Petroplus (Meijknecht, Correljé, & van Holk, 2012). Quite often their funding sources are a combination of venture capital and equity, which limits their access to funds and results in weak balance sheets and limited investment capital available (Cuthbert, Leavens, Kennaby, & Birch, 2011). The previous force these companies to rely more on debt for executing their strategies, which puts them in greater danger in time of business cycle downturns. Since the dynamics in the European refining sector are still putting a lot of pressure on refiners, it is less likely that independent refiners will proceed with acquisitions of or other types of major investments in European refineries.

### 2.2.5 Others

It has been already mentioned that under the category "others", three subgroups of companies can be found. The first one includes the niche refiners like Nynas, Asfaltos Espanoles, etc., which own and operate small refineries and are specialized in production of a specific oil products like asphalt and bitumen. The second group consists of conglomerates and marketers like Vitol, ERG, LyondellBasel, Gunvor, Royal Vopak etc., who own and operate refineries either because they are interested to exploit arbitrage opportunities across the refining and transport (of both crude and oil products) segments of the oil value chain or because they target to become more integrated upstream in the oil value chain. The last group includes private equity funds which are interested in acquiring refineries at cheap prices because they perceive some financial opportunity.

The vast majority of the total European refining capacity in the hands of “others” can be found in the second and the third group. In terms of shifts in refineries ownership, it is noteworthy that throughout the period 2008-2012, the “others” acquired around 758 kb/d of refining capacity but also sold or put for sale another 701 kb/d (Meijknecht, Correljé, & van Holk, 2012).

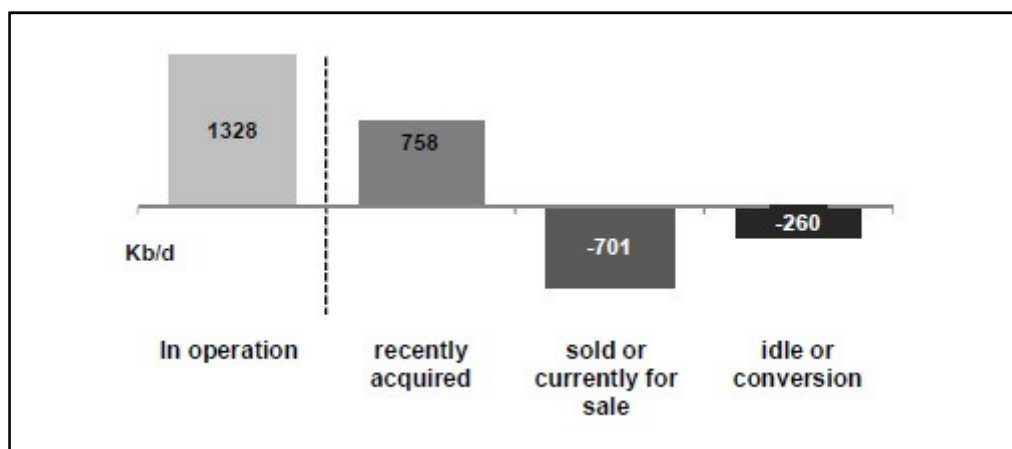


**Figure 7: Restructuring of European refineries owned by “other” refiners (2008-2011).**

(Meijknecht, Correljé, & van Holk, 2012); (Based on an analysis of the Clingendael International Energy Program and on data from Purvin & Gurtz and various newspapers)

Niche refiners seem to maintain a stable presence in the European refining sector, without any significant transactions related to refinery acquisitions reported over the past years. However, representatives of the private equity funds group and of the conglomerates and marketers group have certainly been very active in acquisitions of shares in European refineries over the past years.

Concerning the former group, there are some very notable examples of acquisitions of refineries in Europe. The first was performed by the Klesche & Co. in 2010, which bought the 90 kb/d Heide refinery in Germany by Royal Dutch Shell (KPMG, 2012). Another example comes from Varo Energy Group, a joint venture between the private investment company AtlasInvest and Vitol Group, which bought the Cressier refinery in Switzerland from Petroplus in 2012 with the purpose to restart the plant operation (Ernst & Young, 2013). Furthermore, according to recent reports, the private equity fund Carlyle International Energy Partners (CIEP), part of the private equity firm Carlyle Group, agreed late 2013 to acquire a 50% stake in Varo Energy from AtlasInvest, which in turn made it owner of the Cressier refinery as well (along with other storage and distribution facilities in the region) (Bousso & Zhdannikov, 2013). In a separate deal in 2013, Varo Energy (with CIEP already as a shareholder), acquired a 45% ownership stake of the 260 kb/d Bayernoil refinery in Bavaria (Germany), from OMV Deutschland, member of the Austrian OMV Group (Preqin, 2013).

Then it is the case of the group of conglomerates and marketers, which have been deeply involved in refineries acquisitions in Europe over the past years. Some of these companies may also be private equity firms, such as Hestya Energy, which in 2011 acquired the 260 kb/d Wilhelmshaven refinery in Germany from ConocoPhillips. Hestya’s target was to convert the refinery and use it as a terminal, since the company believed that the low-complexity plant could not become profitable under the conditions prevailing in the European refining industry, while the plant’s oil storage capacity (1.2 million m<sup>3</sup>) could offer significant revenues. Moreover, oil storage facilities can generate relatively stable cash flows,

which allows a private-equity firm such as Hestya, with possibly limited investment capital available, to become more leveraged and execute their strategies (Meijknecht, Correljé, & van Holk, 2012). One more example is LyondellBasel and the acquisition of the 105 kb/d Berre L' Etang refinery in France in 2008, from Royal Dutch Shell (KPMG, 2012). The company bought the refinery in an effort to move upstream on its value chain and secure supply by one of its main feedstock suppliers (Meijknecht, Correljé, & van Holk, 2012). Nevertheless, after some years with low refining margins, the company announced its intention to sell the plant in 2011. No bidders were found which led LyondellBasel to the decision to shut down the plant in 2011 and finally the company decided in 2012 to mothball the plant for two years (Elliot, 2013); (Oil and Energy Trends, 2014).

Furthermore, the recent years have seen many firms with a trading background getting involved in the refining business in Europe via acquisitions of refining assets. The first example has already been mentioned and is the case of Vitol, which through the Varo Energy joint venture became in 2012 owner of the Cressier refinery in Switzerland and in 2013 shareholder in the Bayernoil refinery in Germany. Vitol bought one more refinery in 2010 from Petroplus, namely the 100 kb/d refinery in Antwerp, Belgium, which the company currently operates along with other refining assets in its portfolio (IEA, 2013b). One other major commodities trading firm which recently bought refining assets in Europe, is Gunvor Group. The company acquired two refineries in Antwerp-IBR (Belgium) and Ingolstadt (Germany) from Petroplus, following the latter's bankruptcy in 2012. It is noteworthy that Gunvor was interested to restart the refineries and operate them, thus position itself also in the refining business in Europe. Royal Vopak, a firm also specialized in trading, created in 2012 a joint venture with Royal Dutch Shell and Greenergy, which eventually acquired the Coryton refinery (UK) from Petroplus. The joint venture had plans to invest and transform the plant site to an import and distribution terminal to be managed by Royal Vopak (Ernst & Young, 2013).

To conclude about the "other" companies, the most active have certainly been the private equity funds and firms, as well as many commodities trading companies, which altogether have invested in several European downstream assets over the past years. In principle, their rationale for proceeding with these investments is related to efforts to exploit arbitrage opportunities or otherwise stated to "buy low and sell high" (Meijknecht, Correljé, & van Holk, 2012). The reality is that there are old, simple and land-locked refineries which have been put for sale at low prices, since there are not many buyers willing to invest in them (Ernst & Young, 2013), and these assets represent potential arbitrage opportunities for these types of "other" companies. The reason is that they can buy these distressed refineries, often at bargain prices, and then try to increase the value of these assets not by investing in upgrading the plants but by changing their use altogether with different business models. Hence, it is not uncommon to notice refining sites being transformed to storage facilities and terminals, something facilitated by the existing storage and logistics infrastructure on site. Once value of the assets has been increased under the new business model, they can be sold again at a higher price, creating in this way a profit for their owners (Meijknecht, Correljé, & van Holk, 2012). It seems therefore that the investments of private equity and trading firms in European refineries usually have a short-term horizon, with the firms interested to resell an asset at a profit within a period of 5-7 years (Cuthbert, Leavens, Kennaby, & Birch, 2011).

Of course, there are cases where private equity firms and especially commodities trading companies have acquired refineries and are still operating the plants. In many cases, they have proceeded with these acquisitions because they want to use refineries as leverage for their commodity trading activities (Ernst & Young, 2012a). However, there are also other reasons; these companies do not have a background in refining and especially trading companies have a business model based on keeping costs

low and operating on tight margins (Oil and Energy Trends, 2013). Hence, they do not want to use refineries for making profits as a stand-alone operation, but they want the plants in order to complement their core trading business, enhance their operational efficiency across the supply chain and take advantage of the increased optionality offered by ownership of these assets (Elliot, 2013); (Pirrong, 2014). After all, their expertise is related to closely tracking prices across many markets and moving quickly to take advantages of low crude or high product prices. In this sense, ownership of refineries offers them the opportunity to supply their plants with the appropriate alternative crude feedstocks (in terms of country of origin and cost), process them and meet volatile demand for different oil products across various markets, while making a profit from price differentials. In other words, their profitability is largely determined from their logistics efficiency and not from their expertise in refining (Oil and Energy Trends, 2013). These considerations can also explain why companies specialized in commodities trading are not concerned with costly upgrading investments in their European refineries for increased diesel production, in order to make them profitable. Furthermore, capital expenditure burden for traders is even lower compared to the one of traditional refiners, if taken into account that the former can acquire refineries at really low prices following the bankruptcy of the previous owners of these assets (Oil and Energy Trends, 2013).

### 2.3 The increasing importance of storage facilities

The discussion in the previous paragraphs revealed that there are several cases where oil and trading companies have been often converting refining facilities in Europe to storage or terminals. This is the case particularly for the small, land-locked European refineries which are of a low complexity. The option of conversion is being perceived sometimes as a good alternative to closures, since operators of these refineries can extend the useful life of their asset, can reduce the plant costs and release working capital, and more importantly can avoid significant capital outlays for site remediation and other legal and employee compensation costs (KPMG, 2012). However, mitigation of closure costs and extension of assets lifetime is not the only motivation for these conversions. A strong driver for these decisions has also been the increasing demand for storage capacity in Europe over the past years, due to mainly four reasons (Ernst & Young, 2014, p. 15); (1) the increasing geographic imbalances between refining production and consumption, (2) the increasing products with different specifications to comply with regulations, leading to a greater need of segregated storage and blending capabilities, (3) the increasing activity from independent retailers/distributors and hypermarkets and, (4) the impact of oil trading, contango storage and compliance with compulsory stock obligations. Furthermore, it is expected that due to an expected steep decline in North Sea crude oil production after 2018, there will be increased need for imports of crude oil produced outside Europe, eventually translated to increased crude oil storage requirements from 2018 and onwards (Cooper, S. & Wood Mackenzie, 2013). All of these considerations highlight the increasing importance of storage assets and terminals, which can help explain why many underperforming refineries may end up to be converted, rather than be shut down. After all, refineries are always accompanied by existing logistics and storage infrastructure on site, which can be of high value for crude oil and refined products trading purposes.

European storage capacity at an aggregate level has changed following different patterns in different regions. So for example, whereas storage capacity in France has been contracting, in areas such as the ARA region (Amsterdam, Rotterdam and Antwerp) but also the south of Spain, the storage sector has been expanding over the past years. The storage capacity booming in these regions can be largely

attributed to their logistically beneficial locations which can facilitate long-haul trading, particularly between the Pacific and Atlantic Basins (IEA, 2013b).

## 2.4 Concluding remarks about the different corporate investment strategies

The previous discussion highlighted the investment trends in the European downstream oil sector, with a clear focus on refining assets. Most important trends include asset divestments by IOCs and to a lesser extent, by independent refiners, while several types of new entrants are positioning themselves in the industry. These are mainly the National Champions from emerging economies, followed by trading companies, and to a lesser extent by NOCs from producer countries. All of these companies have different strategies and there are different drivers behind their decisions to proceed with investments or divestments of downstream assets in Europe.

Nevertheless, the dynamics in the European downstream oil sector and the profile of the new asset owners has raised some questions about the security of supply in Europe and the competitiveness of the European refining sector in the long run. The continuous shut downs of refineries, means that the region is increasingly becoming dependent on imports of oil products from other regions, which can potentially endanger its security of supply or simply result in higher costs for oil products. In this respect, apart from plants shut downs by refiners, acquisitions of refining sites with the purpose of their transformation into storage can potentially be problematic. Retaining sufficient refining capacity in Europe should be a key consideration in order to avoid the import overdependence risk. Moreover, the increasing reliance on imports as well as the increasing level of foreign investments in European downstream oil assets has already raised concerns in the EC about the future energy security of Europe, from a political perspective. These concerns are largely related to the increased dependence on imports of crude oil and refined products from Russia, along with the growing presence of Russian companies in the European downstream oil sector, which are gaining larger control of the EU's energy business (Oil and Energy Trends, 2013).

Another serious issue has to do with the long-term competitiveness of the European refining sector under the new ownership structures. To start with, the fact that many private equity and trading companies are interested to acquire and operate cheap refining assets, which are usually old, simple refineries in disadvantaged locations, results in a prolonged refining overcapacity (Oil and Energy Trends, 2013). This is one of the main problems for the profitability and cost-competitiveness of the sector as it was discussed in previous paragraphs. If these firms would not proceed with these acquisitions, the aforementioned refineries were most likely to shut down. Hence, total capacity would then be reduced and some relief from higher margins would probably be given to the remaining more sophisticated, larger and well-located refineries in Europe.

However, this should not be the only concern about the competitiveness of the sector. What is more important is to consider which of the new owners of European refineries have indeed a long-term plan for these assets and are considering upgrading investments, in order to make them meet the competition and market requirements. As it was argued in the previous paragraphs, National Champions from emerging countries and NOCs from producer countries have been increasingly acquiring refining assets in Europe but their main focus and priority remains on their home markets. In this respect, it is not certain that these companies will extensively proceed in upgrading investments in their European refineries, despite of their ample financial capabilities. The strategy of private equity and commodities trading firms has already been analyzed and it does not include upgrading

investments in their refining assets in Europe, as their focus is on exploiting any arbitrage opportunities or using their refineries to complement their core trading operations.

However, the reluctance to proceed with investments in European refining assets characterizes also the traditional owners of European refineries. Independent refiners are extremely exposed to the tight refining margins and to the general deteriorating economic environment, which, coupled with their weak financial capabilities, makes them unable or unwilling to invest in acquisitions or upgrading of refineries. European National Champions have invested in upgrading and desulphurization units in their refineries, up to a certain extent, but they will need to continue spending. However, these companies sometimes do not possess the financial resources necessary for capital intensive investments. Moreover, their strategy formulation and execution is largely determined from their home governments, where non-economic considerations become important and retaining unprofitable assets in the portfolio for political reasons is not unusual. The previous arguments mean that these National Champions are not capable, in certain cases, to allocate the necessary capital for refineries-upgrading investments or cannot easily rationalize their refining capacity, hence release working capital to be employed elsewhere.

Last but not least, the IOCs which have ample financial resources remain committed to their strategy of consolidating their downstream assets in Europe and divesting many of these assets, alongside with focusing on their upstream operations and on their downstream presence in growth markets. The IOCs will continue with divestments of downstream assets in Europe and only in exceptional cases they will invest in their European refineries. The refineries which will attract these investments will be market-winning plants, of sufficient scale and/or complexity, which are positioned in advantageous locations.

The multitude of different strategies and different considerations when it comes to taking investment or divestment decisions for assets in the European downstream oil sector is obvious. Firms involved in the business are moving towards different directions, driven by different rationales and of course, this obviously means that they also perceive differently the dynamics in the sector. The motivation behind their actions is what this research is trying to explore, and the first step in this effort is to confide to the theoretical frameworks which can help understanding the nature of the European downstream oil sector.

### 3. TCE and TCR in the context of the European downstream oil sector

What follows in this Chapter is a literature review about the Transaction Cost Economics and the Transaction Cost Regulation theories, with a special focus on the main constructs of these theories. This is because many of these constructs will guide the author of the thesis in his effort to describe the idiosyncratic characteristics of the European downstream sector. Therefore this literature review is accompanied by the description of how these theoretical constructs can be used to depict these characteristics. Subsequently, a new theoretical framework is proposed, which also helps to answer the first research sub-question of this research.

#### 3.1 Transaction Cost Economics

The well-known theory of Transaction Cost Economics (TCE) has its origins in the much cited work of Coase (1937). In the *Nature of the Firm*, Coase was the first to describe market and hierarchies as alternative forms of governance structures. The author argued that choosing between markets and hierarchies was a matter determined mainly from differences in transaction costs (Coase, 1937); (Geyskens, Steenkamp, & Kumar, 2006). Nevertheless, the work that became a catalyst for the popularity of TCE and subsequently led many researchers to focus on studying and testing this theory, was the seminal book *Markets and Hierarchies* by Williamson (1975); (Grover & Malhotra, 2003); (Geyskens, Steenkamp, & Kumar, 2006). The reason for the increased focus on TCE after Williamson's work, is that he was able to operationalize transaction costs and as Geyskens et al. (2006, p. 519) mention "(Williamson) demonstrated that testable hypotheses could be developed by associating the relative efficiency of alternative governance structures with observable dimensions of transactions, namely asset specificity, uncertainty, and transaction frequency". The author of this thesis will return to discuss asset specificity, uncertainty and all the other constructs of TCE in subsequent paragraphs.

For now, what can be said is that Williamson (1975) discussed the dilemma between markets and hierarchies and refined the concepts posed by Coase (1937). In Williamson's work, the focus is on transactions or (otherwise) units of exchange. The basic idea is that markets and hierarchies (or firms), are suggested as alternative governance mechanisms (or structures) aiding to complete a level of transactions (Williamson, 1975); (Grover & Malhotra, 2003). To elaborate on this, Williamson's (1975) TCE put forth the notion that in order to have an efficient organization, it is necessary to match transactions which require a higher level of coordination with organizational governance forms, which can provide the level of coordination required in a cost-effective manner (Leiblein, 2003). The basic assumption in TCE is that market governance is in general more efficient than hierarchical governance, due to economies of scale, scope and other benefits of competition it can achieve. However, there are specific dimensions of transactions that might raise transaction costs and create market failures. When the cost of doing transactions under certain conditions is too high, TCE advocates organizing these transactions within the firm (or hierarchy) governance structure, in order to minimize this cost. On the other hand, use of the market governance structure should be preferred when transaction costs are low (Williamson, 1975); (Williamson, 1971) (Leiblein, 2003); (Grover & Malhotra, 2003); (Geyskens, Steenkamp, & Kumar, 2006); (Lyons, 1995). Therefore, the core dilemma TCE theory poses is whether it is preferable, in terms of efficiency, to perform a transaction within a firm through vertical integration

or outside of it, using autonomous contractors (market governance) (Geyskens, Steenkamp, & Kumar, 2006).

Williamson has described in details the nature of the hierarchy and market governance mechanisms, the two extremes of the spectrum of possible governance structures. However, he presented and analyzed as well the different types of hybrid governance structures that might exist (Williamson, 1975); (Williamson, 2008); (Williamson, 2005); (Grover & Malhotra, 2003). Moreover, the concept of vertical integration, as a means of minimizing transaction costs, has received tremendous attention both by Williamson and other scholars. However, it is out of the scope of this Chapter to explain the advantages and disadvantages of the different types of governance structures. The focus will rather shift on the nature of the causes giving rise to transaction costs, which in turn creates the impetus to make a choice between the different governance structures. The reason for drawing the attention on these causes is that, as it will be described, these transaction costs have a strong presence in the downstream oil industry and consequently can affect investment choices of corporations involved in this business.

## 3.2 The causes of transaction costs

In the effort to describe the nature of the causes of transaction costs, it is imperative to refer to the main assumptions which underlie TCE. The two main assumptions are the bounded rationality of individuals and the existence of opportunism (Williamson, 1973); (Williamson, 1975); (Rindfleisch & Heide, 1997) (Geyskens, Steenkamp, & Kumar, 2006); (Leiblein, 2003).

### 3.2.1 Bounded rationality

The term bounded rationality was first coined by Simon (1957) in order to describe the neurophysiological and language limits of individuals. Williamson (1973, p. 317) mentions that “bounded rationality refers to rate and storage limits on the capacities of individuals to receive, store, retrieve, and process information without error”. What bounded rationality means within the context of an organization is that, even though decision makers have all the intention to make a rational decision, they are faced with limited capacity to accurately evaluate all possible alternative decisions. (Grover & Malhotra, 2003); (Hobbs, 1996). This practically means that they cannot adequately predict and plan for the future and for the various contingencies that may arise. The consequence is that it becomes costly, with respect to time and budget, for individuals to acquire and interpret information about the contracting environment of a specific transaction (Leiblein, 2003). However, it should be stressed that bounded rationality alone does not necessarily lead to increased transaction costs. It is the combination of bounded rationality of individuals in situations where they belong in an environment of high complexity and uncertainty, which poses a problem (Hobbs, 1996); (Grover & Malhotra, 2003); (Rindfleisch & Heide, 1997). It is in these cases where decision makers are facing difficulties to incorporate in contractual arrangements of transactions all possible contingencies, resulting in incomplete market contracts. However, incomplete contracts can lead to a rise of transaction costs in the form of renegotiation costs related to specifications and prices, or responsibilities and rights of the parties involved in the transaction (Grover & Malhotra, 2003); (Leiblein, 2003); (Williamson, 1971). These costs might arise because new circumstances may emerge, not existing at the time of the original contractual arrangement, and this can lead to a situation where individuals will have to negotiate revised terms which address the unanticipated contingency (Leiblein, 2003). During these

renegotiations, individuals may be tempted to exploit the vulnerabilities of their exchange partners “in the hope of achieving a more favorable distribution of the joint economic profits derived from the exchange” (Leiblein, 2003, p. 940). In the end, usually two types of costs incur when all the previous conditions occur, negotiation and monitoring (or enforcement) costs. The former include costs of negotiating, writing contracts (the hiring of lawyers etc.) or paying for the services of a third intermediary party (broker house etc.), while the latter include monitoring the quality of goods from a supplier, monitoring the behavior of buyers and suppliers with respect to the agreed contract terms, and legally enforcing a contract in cases of violation of its terms (Hobbs, 1996).

### 3.2.2 Opportunism

The second basic assumption of TCE is the idea that individuals will seek to act with self-interest given the opportunity (Rindfleisch & Heide, 1997). Williamson (1975, p. 26) defines opportunism as “self-interest seeking with guile” and this includes behaviors such as cheating, lying and subtle forms of violation of agreements (Grover & Malhotra, 2003); (Rindfleisch & Heide, 1997). What should be highlighted though is that the assumption of opportunism does not imply that all individuals involved in transactions will behave opportunistically, rather it stresses that the risk of opportunism is often present (Hobbs, 1996). Moreover, the bounded rationality of individuals suggests that it is actually quite costly to be able to identify untrustworthy individuals ex-ante a transaction (Williamson, 1996). Nevertheless, there are two other concepts which are closely related to the risk of opportunism, namely the small numbers issue and the asset specificity. Since these concepts will be elaborated in the following paragraphs, the author of this thesis will be confined to state that the risk of opportunism is higher when, for example, there exists a small number of suppliers available to a buyer or when the exchange relationship between two parties is based on assets which have less value outside of the environment of this relationship (Williamson, 1975); (Williamson, 1973); (Hobbs, 1996); (Rindfleisch & Heide, 1997). Eventually, the presence of opportunism may lead to higher transaction costs in the form of monitoring behavior, safeguarding assets and ensuring that the exchange party in a transaction does not engage in opportunistic behavior (Grover & Malhotra, 2003).

## 3.3 TCE constructs and their application in the context of the European downstream oil sector

Apart from the key assumptions underlying TCE, the constructs of the theory is the second important pillar upon which the rationale about the rise of transaction costs is based. These constructs include asset specificity, uncertainty, transaction frequency, small numbers situations, information asymmetry and the governance structures (Williamson, 1975); (Williamson, 1973); (Leiblein, 2003); (Grover & Malhotra, 2003); (Geyskens, Steenkamp, & Kumar, 2006); (Hobbs, 1996); (Rindfleisch & Heide, 1997).

### 3.3.1 Asset specificity

This is one of the most famous constructs of TCE theory. Asset specificity refers to the transferability of assets that support a given transaction (Williamson, 1985). When the assets are indeed specific to a transaction, then their value will decrease outside of the context related to this transaction. Highly specific assets cannot easily be redeployed in a different context and outside the relationship of the parties to the transaction (Mayer & Salomon, 2006); (Grover & Malhotra, 2003); (Geyskens, Steenkamp,

& Kumar, 2006). It can be said that assets which belong in this category of high specificity, represent sunk costs which additionally cannot be used elsewhere but only within the environment of a particular exchange relationship (Rindfleisch & Heide, 1997). Highly-specific assets have therefore an idiosyncratic nature which may give rise to transaction costs in the form of safeguarding problems as market competition will not restrain opportunistic exploitation (Geyskens, Steenkamp, & Kumar, 2006). Consequently, when assets of this dedicated nature are required for a transaction, it might be the case that suppliers may act opportunistically to extract excessive rents (quasi-rents) from customers (Mayer & Salomon, 2006); (Hobbs, 1996). An example would be between two firms A and B, where A would have to proceed to dedicated investments in assets to be used specifically for a transaction between them (to provide firm B with products for example). If these assets cannot be used for other transactions, then firm A will be locked-into the specific exchange between A and B. Then B, knowing this, might be tempted to act opportunistically as it could, for instance, renege on the previous agreement between the two firms by offering firm A a lower price for the product (Hobbs, 1996). Therefore, there is a shift in the bargaining power of both suppliers and buyers when investments in specific assets have been realized (Walker & Poppo, 1991); (Williamson, 1975). It becomes then apparent, that in order to mitigate the risk of opportunistic behavior of partners in an exchange relationship where assets are specific and prevent suppliers from “holding up” customers, detailed contracts or other safeguarding measures are required. However, costs accompanying these measures can be significant and TCE advocates that in these cases, it is preferable to organize the transactions internally through vertical integration (Mayer & Salomon, 2006); (Geyskens, Steenkamp, & Kumar, 2006).

Additionally, asset specificity includes several different dimensions. Williamson (1996) identifies six types of asset specificity: (1) site, (2) physical asset, (3) human asset, (4) dedicated asset, (5) brand name capital, and (6) temporal. These dimensions are all illustrated in the following figure.

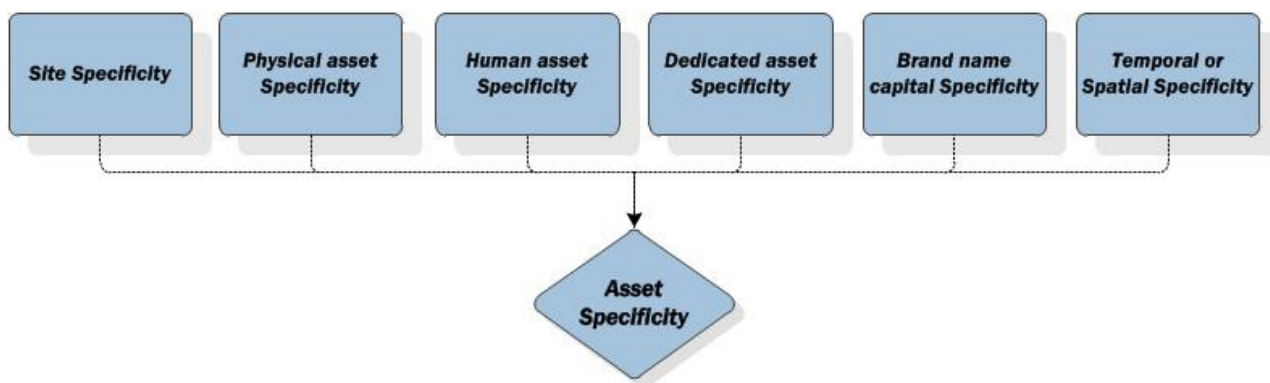


**Figure 8: The six dimensions of asset specificity.**

The different types of specificity are described below (Williamson, 1996); (Leiblein, 2003):

- (1) Site specificity refers to the co-location of facilities so as to minimize inventory or production costs. Williamson (1983) and Joskow (1985) mention that site specificity describes a cheek-by-jowl relation between a supplier and a buyer, which reflects an ex-ante decision to minimize inventory and transportation expenses. Moreover, highly site-specific assets are also assets which are highly

immobile once in place, because the set up and/or relocation costs are great (Williamson, 1983); (Shelanski & Klein, 1995).

- (2) Physical asset specificity refers to the use of co-specialized assets that are customized for a particular use or purpose. Increased physical asset specificity occurs when one or both parties to one transaction make investments in equipment and machinery that involves design characteristics specific to the transaction and which have lower values in alternative uses. This equipment or machinery is thus relationship-specific (Williamson, 1983); (Joskow, 1985); (Shelanski & Klein, 1995).
- (3) Human asset specificity refers to an employee's development of firm-specific skills or knowledge. Anderson (1985, p. 238) mentions that "transaction-specific assets are also of a human nature in the form of special-purpose knowledge and working relationships, which arise in a learning by doing fashion and create specific, rather than general, human capital". In addition to the learning-by doing manner of human asset specificity creation, Joskow (1985) argues that it can be created as well through investment and transfer of skills (specific human capital) specific to a particular relationship. A last interesting point about human asset specificity has been made by Monteverde (1995), who identifies that this kind of specificity might exist as well in the form of organization-specific communication codes.
- (4) Dedicated asset specificity refers to additional investments in plants or equipment made in order to sell the increased output to a particular customer. Investments for these assets are discrete and would not take place but for the prospect of selling a significant amount of product to a particular customer. The value of these assets would be lower if they were to be employed in alternative uses (or used by or to service alternative users). Dedicated assets thus are those that are put in place contingent upon particular supply agreements and, in cases of premature termination of these contracts, a supplier would be left with significant excess capacity (Williamson, 1983); (Joskow, 1985). Dedicated assets might give rise to transaction costs harming both buyers who face the risk of "hold ups" from their suppliers, but also suppliers who face the risk of becoming a "hostage" of their buyers. In the former case, a supplier investing heavily in dedicated assets could act opportunistically and try to extract higher rents from the relation with its buyer, as for the buyer, the option to change its supplier might be too costly and therefore compliance with the supplier's demands might be necessary. In the latter case, a supplier who invests heavily in dedicated assets becomes more and more dependent on the relation with its buyer, which shifts the bargaining power for both of them in favor of the buyer (Frazier, Spekman, & O'Neal, 1988); (Williamson, 1975); (Williamson, 1985).
- (5) Brand name capital specificity refers to investment in reputation, for instance through advertising. Gatignon and Anderson (1988) explain how this type of specificity creates control problems, as it is especially subject to degradation (Klein, 1980). These control problems can be severe when there is room for one party to free-ride on another party's efforts and capture benefits without having to bear costs. This is the case of an international firm with a brand name of high value (franchisor) and a local operator who represents this firm (franchisee). It might be the case that the local operator, by using the strong brand name of the firm, will claim short-term gains at the expense of the long term. In such a case, when the brand value of a firm is high and there is increased risk of free-riding on its brand name capital from local operators, the firm should take control in order to prevent them from diluting or confusing the international positioning of the brand (Gatignon & Anderson, 1988); (Klein, 1980).
- (6) Temporal or spatial specificity refers to investments made to facilitate the timely response or coordination of human assets. This is one of the dimensions of asset specificity which was not part of the original work of Williamson. The term temporal specificity was first introduced by Masten,

Meehan and Snyder (1991), who also explained how opportunistic behavior might emerge where time dimension of a transaction plays a crucial role. The authors mention that (1991, p. 9):

“Knowing that interruptions at one stage can reverberate throughout the rest of the project, an opportunistic supplier may be tempted to seek a larger share of the gains from trade by threatening to suspend performance at the last minute. Even though the skills and assets necessary to perform the task may be fairly common, the difficulty of identifying and arranging to have an alternative supplier in place on short notice introduces the prospect of strategic holdups”

The authors also make the remark that in cases where the need for precise scheduling of a firm's activities is high, temporal specificity risks might be high as well, accompanied with the potential for strategic delays. These conditions are increasing the prospective transaction costs of dealing with subcontractors. Consequently, the great potential for strategic holdups in market transactions makes the cost of renegotiating contracts to exceed the benefits of the market governance structure, and this eventually increases the probability of vertical integration (Masten, Meehan, & Snyder, 1991).

### 3.3.2 Asset specificity and the European downstream oil sector

When it comes to use the asset specificity construct for describing the specific nature of assets in the (European) downstream oil industry, all of its aforementioned six dimensions are taken into account. Nevertheless, as it will be discussed, not all of them have the same degree of usefulness. Moreover, as an important element of the analysis in the next paragraphs are the assets of the downstream oil sector, it should be stressed as a reminder, that these assets are considered to be only refining facilities, storage facilities and terminal facilities.

#### *Site specificity*

This is one of the most important types of specificity, when it comes to describing the downstream oil sector, as the assets involved are highly site-specific.

At first, the focus will be on refining facilities. Building refining facilities requires a vast amount of investments which are sunk and the incurred capital costs are fixed (Correljé & van Geuns, 2011); (Frankel, 1969); (Kesicki, 2010). This is accompanied by the fact that refineries once built to a certain location cannot be relocated; therefore they are subject to local market circumstances. These include local market conditions (over supplied/under supplied market, different types of product demand, production costs), local taxation on profits, local environmental legislation and local regulatory and political environment (including labor laws) (Meijknecht, Correljé, & van Holk, 2012); (Penrose, 1968) (A. T. Kearney, 2012); (Cuthbert, Leavens, Kennaby, & Birch, 2011). For example, excluding local market demand requirements, a refinery might be subject to unfavorable regulation with respect to fuel quality standards, to unfavorable HSSE standards, to unfavorable tax regimes which for example favor imports over domestic productions and it might be enjoying little or no political support. All these factors can significantly influence the value creation of the refining business in a specific location (A. T. Kearney, 2012); (Fahim, Al-Sahhaf, & Elkilani, 2010). European refineries are affected drastically by the national and European legislation aiming to stimulate the adoption of “green” transport fuels, from the stringent fuel and emission quality standards, and from the policies with respect to the levies on different fuels with the goal to stimulate consumption of diesel in place of gasoline (Meijknecht, Correljé, & van Holk,

2012). Additionally, European refiners due to their site- specificity are more vulnerable to the strong labor legislation (KPMG, 2012) in some European countries and are subject to the higher cost of labor compared to other regions of the world.

The site-specific nature of refining facilities can also be illustrated when the facility is unprofitable and there are considerations to shut it down. The decision to close a refinery will be drastically affected by the local environmental regulation concerning the obligations for cleaning-up the area the refinery is located. Substantial regulations may require the removal of the accommodated pollution resulting from decades of past use where the requirements were less strict than the current ones. Other issues may be the local labor laws which may entail significant costs of severing the refinery employees' contracts and the conflicting interests of the local government, regulators and employees which can eventually lead to protracted disputes and significant legal costs (KPMG, 2012). All the previous, in essence, constitute a barrier to exit the refining business (Meijknecht, Correljé, & van Holk, 2012), which depending on location, can be too high.

Refineries need to procure crude oil and other feedstocks to process, and then they should be able to distribute their output in the marketplace. This makes refining facilities highly site-specific for one more reason, namely their location has a crucial role to play when it comes to accessibility to major transportation channels and open sea, but also to logistic assets infrastructure, such as pipelines etc. (Meijknecht, Correljé, & van Holk, 2012); (A. T. Kearney, 2012); (Cuthbert, Leavens, Kennaby, & Birch, 2011). Refineries located at a coastal line in proximity to a deep-water port, which is capable of handling large crude carriers (up to 270 thousand tones DWT), have an obvious advantage compared to land-locked refineries, especially if crude is supplied from a long distance. This is because in this case freight costs are lower and there is higher crude supply flexibility (Cuthbert, Leavens, Kennaby, & Birch, 2011); (A. T. Kearney, 2012). However, if the refinery is land-locked, then, having access to pipelines for transportation of crude is very important, as other means of transporting crude such as rail or truck, are considered less cost-effective. Furthermore, refineries which are positioned close to the market for their products and have access to product pipeline grids, major inland waterways and other rail and road logistics networks, obviously enjoy higher profitability levels (A. T. Kearney, 2012); (Cuthbert, Leavens, Kennaby, & Birch, 2011).

Apart from refineries, assets such as storage facilities and terminals are also site-specific, as they are fixed to a specific location and they cannot simply redeployed somewhere else. Investing in these assets resembles investing in refining facilities, in the sense that they also require serious investments which are sunk and they have high fixed capital costs (Pirrong, 2014) (Kesicki, 2010). Moreover, storage and terminal operators are subject as well to local market demand patterns, local environmental legislation and local labor-related legislation. Moreover, these operators, like refiners, are subject to local Compulsory Stock Obligations, which in cases may turn out to be a significant burden for the downstream oil industry (Cuthbert, Leavens, Kennaby, & Birch, 2011). Furthermore, it is obvious that the profitability of storage and terminal facilities operators is enhanced if their assets are located close to major logistics networks.

A final remark is that the site-specific character of assets in the downstream oil sector in Europe makes their operators dependent on local economic conditions and growth, which both deteriorated the previous years in many European countries due to the Euro-crisis.

### *Physical specificity*

This is the second highly important dimension of asset specificity, along with site asset specificity, when it comes to describe the nature of the European downstream oil sector.

Refineries will be again the starting point for this analysis, as these assets are characterized by very high physical specificity. This is because refineries are often custom built to handle a particular type of crude oil mix and they are fairly dependent on it, as switching costs can be very high (Meijknecht, Correljé, & van Holk, 2012); (Al-Obaidan & Scully, 1993); (A. T. Kearney, 2012). Next to this, refineries are configured for refining a specific amount of crude oil in a typical multi-product process, which yields a multi-product output consisting of several fuels (fuel oil, kerosene, gasoline, and so on) in amounts which are usually fixed proportions of the amount of crude processed (Correljé & van Geuns, 2011); (Meijknecht, Correljé, & van Holk, 2012); (Ellis Jones, 1988). These fixed proportions vary depending on the complexity of the refinery and the technologies it is using. However, demand for different oil products often does not follow this pattern of fixed proportions, which practically means that there is always a surplus or deficit of certain products in the market which affect their relative prices. Hence, refinery management has always to seek to produce the mix of products and quality standards required by the market, if it is to achieve a satisfactory margin (Ellis Jones, 1988); (Frankel, 1969). However, adjusting the production of one product in accordance to a shift in its relative market demand or price inevitably entails a change in the production of the other products as well. It may, though, be the case where the markets for the other products are already oversupplied, which in turn has reduced their prices and this, in the end, will lead to a reduction of the refiners' revenue from processing the extra barrel. In Europe there is currently a diesel, gasoil and kerosene deficit, alongside with a surplus of gasoline, and many European refineries are configured to produce more gasoline. If demand for middle distillates will sustain itself or increase even further, European refiners will be confronted with difficulties to sell all the other products, and may be forced to seek recourse in the global oil products market where competition is fierce (Meijknecht, Correljé, & van Holk, 2012).

Apart from the physical specificity related to the configuration and complexity of refineries, there are other elements which can highlight the high physical specificity of refineries. These are the size and the age of a refinery. Refineries exhibit strong economies of scale as a larger unit which can process a larger amount of crude, requires approximately the same manpower, maintenance activity and management time as a smaller processing unit. Therefore, fixed operating costs per barrel of oil throughput are decreasing and thus, with a large unit there will be a higher net margin per barrel (Cuthbert, Leavens, Kennaby, & Birch, 2011); (Frankel, 1969); (Ellis Jones, 1988); (A. T. Kearney, 2012). Nevertheless, changing the scale of a refinery requires significant capital investments and long lead times (Ellis Jones, 1988); (Al-Obaidan & Scully, 1993); (KPMG, 2012), which highlights the increased physical specificity of an existing refinery. Moreover, the age of a refinery is an equally important element characterizing the asset's physical specificity. Again, due to the huge capital investments required, it is not an easy decision to build a greenfield refinery. However, as refineries get older they expand with other units and there comes a point where, their operating costs become substantial due to the diversity of units of different age and size added throughout all the previous years. At this point, these refineries have less operational efficiency compared to newer refineries, but this is a situation difficult to change, again due to the combination of serious investments required for increasing their efficiency and the long lead times of these investments (Cuthbert, Leavens, Kennaby, & Birch, 2011). This fact also highlights the high physical specificity of assets such as refineries. Additionally, the significant investments required for building new refineries or upgrading existing ones, at times when there is scarcity of cheap credit, constitute a significant refining business entry barrier (Meijknecht, Correljé, & van Holk, 2012).

Unfortunately for the competitiveness of the European refining sector, the situation is that many refineries are old, of a low scale and complexity, and configured to a product mix which is not matching the market demand requirements.

Physical specificity can also be found in assets such as storage facilities and terminals, although to a lesser extent according to the opinion of the author of this thesis. In general, storing crude oil and refined products requires dedicated assets or as Frankel (1969, pp. 33-34) calls it “specialized equipment”, due to the liquid nature of these products. According to the same author, it is quite common that assets which are used for storage purposes of these liquids, cannot be used for other storing purposes, meaning that they “are no good for anything else”. This is of course the essence of physical asset specificity. Moreover, Pirrong (2014, p. 45) while describing the notion of optionality inherent in asset ownership, makes explicit that many midstream infrastructure assets such as storage facilities and terminals are often sufficiently unique in terms of configuration and size, hence, they are characterized by a certain degree of physical specificity.

### *Human specificity*

This is one of the dimensions of the asset specificity construct, which according to the thesis author’s opinion, is not very suitable or useful for describing the characteristics of the European downstream oil sector. It is believed that there is a sufficient pool of labor force in Europe, of people who are highly educated and with all the necessary knowledge and/or experience required for conducting even the most demanding tasks related to the downstream oil business. Moreover, there are also numerous service companies in the market whose business model is actually based on undertaking tasks and carrying out work of a highly dedicated and specific nature. In this sense, oil and trading companies do not have to provide an extremely specific training to their employees in order to perform the highly dedicated activities. Instead, many firms encourage job rotating programs for their employees, accompanied by formal trainings, in order to provide them with skills related to the whole spectrum of the firms’ activities. Nevertheless, this training cannot be considered really firm-specific; it is rather industry-specific. Therefore, employees obtain knowledge which can be useful within different firm environments and they can easily shift roles by moving to different companies in the same business. Conclusively, the level of human asset specificity in the downstream oil sector in Europe is at least quite low and consequently, this is not a useful construct to be used for describing this sector.

### *Dedicated asset specificity*

This type of asset specificity is also not one of the most suitable constructs to help understanding the nature of the downstream oil sector. It is not very likely for firms involved in the European downstream oil sector to proceed to investments only for meeting the demands of a specific customer. As explained, investments in this business require large capital layouts and involve long lead times and thus payback times, making the decision to invest not an easy one. If firms will decide positively upon investing in new refineries, in upgrading existing ones or investing in storage facilities and terminals, it is something which will be driven by the business opportunities they identify, not in a specific customer or even country level, but in a more generic market level. Their decision is more likely to be influenced by the new global supply and demand patterns, where European market in general requires more middle distillates and not only a specific European country’s market. In addition, environmental legislation becomes more stringent on a pan-European level and there is harmonization of the National

Governments legislation with the European Commission legislation. This means that investments required for meeting the new fuel quality and emission specifications or investments, for example, in bio-fuels, will be undertaken because they are necessary for staying in the business and for serving the European market in general. They will not be necessarily undertaken for serving only one customer or specific market.

Furthermore, even if there will be cases where a firm will proceed to investments with the prospect to serve a specific market, these investments could be seen under the prism of physical asset specificity. It is believed that in the case of the European downstream oil sector, the constructs of physical asset and dedicated asset specificity are closely related and for the reasons explained above, the focus will be more on the physical asset specificity construct.

### *Brand name capital*

This is one more construct offered by the TCE which is not so useful for describing the European downstream oil sector. This is the case because the focus in this thesis is on refining and storage facilities, while local service stations and retail-marketing networks are a part of the downstream sector which is not taken into account. The brand name capital specificity would become interesting and useful in the case of investigating, for example, drivers for investments in retail operations; nevertheless this is out of the scope of this thesis.

### *Temporal asset specificity*

Temporal asset specificity is one of the three dimensions of asset specificity (the others are site and physical), which are considered to be the most suitable to help describe the nature of the European downstream oil sector.

Temporal asset specificity concept has been acknowledged as of particular importance for assets such as storage facilities or terminals (Pirrong, 2014). The same author explains that temporal specificity exists when “even a short delay in obtaining (or selling) a good, imposes a large loss on the buyer (or seller)” (p. 43) and he gives an example using a hypothetical scenario; There is a trading firm who does not possess any storage assets and therefore has its commodities stored in facilities it does not own, under some contract or lease. In the case where demand for this commodity rises sharply, it becomes extremely important for the trading firm to access the commodity as soon as possible and sell it or consume it. However, the storage facility operator realizes this situation and the value the commodity has for the trading firm is obtained in the right time. It may then be the case that the operator will threaten to delay performance, in an effort to extract a part of the high value this commodity now has for the trading firm. The contractual agreement between these two parties may be including measures to prevent such behavior but contracts are often incomplete, so there a contractual gap may exist for this development which was not anticipated. Even in the case such contingencies were anticipated and the contract prescribes how they should be mitigated, enforcing contractual terms might be costly and time consuming, hence the trading firm might prefer to capitulate to the storage operator’s demand. Nevertheless, this kind of temporal specificity risks can be reduced or eliminated if the trader owns the storage asset. Hence, Pirrong’s (2014) ideas match exactly with what Masten, Meehan, & Snyder (1991) advocate for cases where the potential of strategic holdups is high; asset ownership or otherwise stated internal organization (integration).

Furthermore, the underlying reasons for ownership of storage facilities and terminals due to the problem of temporal specificity can be valid for justifying ownership of refining facilities as well. In cases where there are short-run changes in demand for different products in different regions, ownership of refineries can offer increased flexibility and efficient adjustment to these changes in order to exploit any arbitrage opportunities. If there is no refinery ownership, less arbitrage opportunities might be exploited and there will always be a risk for a strategic holdup of a valuable product by another refiner who can provide this product (Penrose, 1968); (Pirrong, 2014).

### *Conclusion about asset specificity in the context of the European downstream oil sector*

From all the aforementioned, it becomes clear that there are three dimensions of the asset specificity construct which can really help understanding the nature of downstream oil sector assets, namely site, physical and temporal specificity. Moreover, dedicated asset specificity can be considered to be part of the physical specificity dimension, while human asset specificity and brand name capital are not very suitable (or helpful) for explaining the downstream oil sector (as the sector is defined in this thesis). As the latter three dimensions of asset specificity will be excluded from the rest of the analysis, Figure 8 which was used to illustrate all asset specificity dimensions proposed by TCE, is now transformed within the context of the European downstream oil sector to the following one.

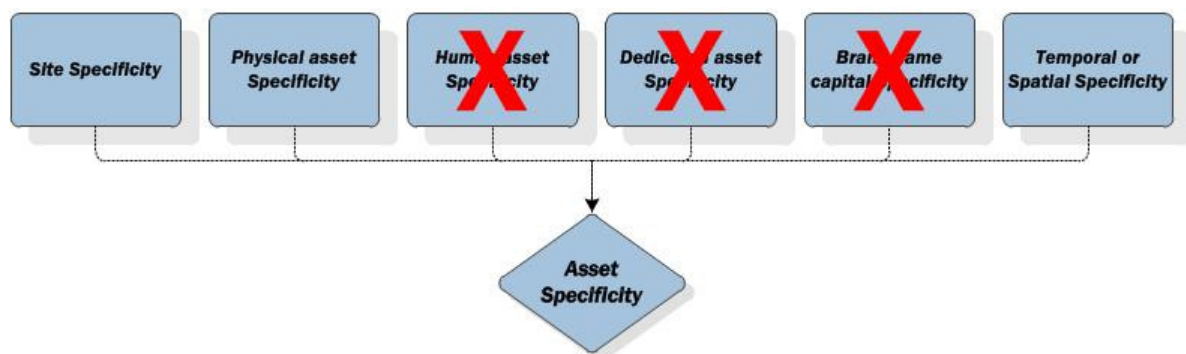


**Figure 9: Relevant dimensions of asset specificity in the context of the European downstream oil sector.**

### **3.3.3 Uncertainty**

The second famous construct of TCE is the one of uncertainty. Williamson (1973) mentions that the effects of uncertainty on economic behavior are extensive and pervasive. When environmental uncertainties become so numerous that it is impossible to fully consider all of them, then these uncertainties exceed the data processing capabilities of parties with bounded rationality. When this is the case, market exchange will be significantly vulnerable to opportunism and therefore, hierarchical governance mechanisms should be adopted (Williamson, 1975); (Williamson, 1973). Hence, TCE theory suggests that the level of market, supplier, or technological uncertainty or complexity in an economic exchange can be significant factors affecting the likelihood of opportunistic behavior and the need for better coordination through hierarchies (Leiblein, 2003). Moreover, by increasing the number of contingencies that may affect a market contract, uncertainty creates room for opportunism and raises the expected costs of writing and enforcing a contingent claims contract (Williamson, 1985). However, the inappropriateness of market exchange in an uncertain environment is not only due to the high costs

of writing complete contracts, but also because uncertain environments ease subsequent contractual renegotiation that can be hazardous if there have been investments in specific assets (Leiblein, 2003).

There are two major types of uncertainty identified in the literature; the environmental and the behavioral uncertainty. The former describes the situation where it is difficult to specify the circumstance surrounding a transaction ex-ante, and the latter refers to the difficulty to verify performance (e.g. of a party) ex-post the transaction (Grover & Malhotra, 2003); (Geyskens, Steenkamp, & Kumar, 2006); (Rindfleisch & Heide, 1997).

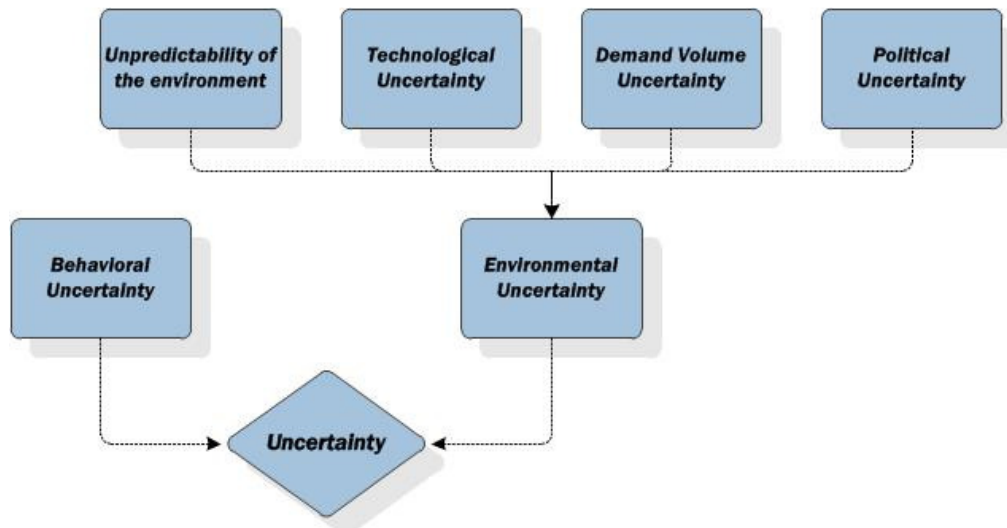


**Figure 10: The different dimensions of uncertainty.**

### ***Environmental Uncertainty***

Environmental uncertainty creates an adaptation problem, as it impedes the ability to adjust agreements to changing circumstances (Geyskens, Steenkamp, & Kumar, 2006); (Rindfleisch & Heide, 1997). This type of uncertainty can be illustrated through constructs such as the unpredictability of the environment, technological uncertainty, demand volume uncertainty and political uncertainty (Grover & Malhotra, 2003); (Rindfleisch & Heide, 1997); (Henisz, 2000); (Walker & Weber, 1984); (Leiblein, 2003).

- **Unpredictability of the environment:** Anderson (1985) describes environmental unpredictability as the situation where a firm's sales environment is volatile and complex, making forecasting and control difficult. She defines unpredictable sales environments as those which are made difficult to forecast by turbulence (otherwise instability) and by venturing into the unknown (new products or new markets). Furthermore, the author emphasizes that complexity, volatility, difficulty to monitor, uncertain markets and high forecast errors, are all items connected to the turbulence of the unpredictable environment.
- **Technological uncertainty:** This dimension of uncertainty was identified by Walker and Weber (1984), who describe it as the uncertainty in terms of change in component specifications. In essence, technological uncertainty is the inability to accurately forecast the technical requirements in a relationship (Walker & Weber, 1984); (Geyskens, Steenkamp, & Kumar, 2006). This kind of

uncertainty may result from unpredictable changes in the standards or specifications of components or end products, or simply by technological developments on a general level (Geyskens, Steenkamp, & Kumar, 2006).

- Demand volume uncertainty: This type of uncertainty is also highlighted by Walker and Weber (1984) who mention that “Volume uncertainty depends on the assessment of fluctuations in the demand for a component and the confidence placed in estimates of the demand” (p. 376). In this case, the uncertainty represents the inability to accurately forecast the volume requirements in a relationship (Walker & Weber, 1984); (Geyskens, Steenkamp, & Kumar, 2006). In case of increased volume uncertainty, suppliers experience unexpected production costs or excess capacity, while buyers experience stock-outs or excess inventory (Walker & Weber, 1984).
- Political uncertainty: This uncertainty is, obviously, related to hazards of political nature which may exist in a specific country. These hazards stem from the political system of this country and may realize in a direct form, for example with seizure of assets by the government of this country, or in an indirect form, like with adverse changes in taxes, regulations or other agreements. Therefore, the state itself, given its monopoly power on legal coercion and its implicit presence in the background of every economic transaction, might pose a threat to firm either through policy shifts in taxation or regulation, or through outright expropriation (Henisz, 2000).

#### *Behavioral uncertainty*

Behavioral uncertainty describes a performance evaluation problem, namely the difficulty to ascertain whether compliance with established agreements (contracts) has occurred (Geyskens, Steenkamp, & Kumar, 2006); (Rindfleisch & Heide, 1997). An important aspect of behavioral uncertainty is considered to be measurement uncertainty, which refers to the difficulty to assess performance (Anderson, 1985). There may be situations where measures of performance are unreliable or invalid, either because records are inaccurate (for example in the case of sales performance measurement) or because no readily observable indicators of what a firm defines as performance exist. Such a situation may occur when performance, as understood by a firm, can only be measured by combining indices of both inputs and outputs (Anderson, 1985). The same author adds that performance measurement for individuals may also be difficult in cases where responsibility is shared by a team. Moreover, behavioral uncertainty may also include information asymmetry problems (Grover & Malhotra, 2003), but this relation will be elaborated in the subsequent paragraph focusing on the construct of information asymmetry in TCE. It should be stressed though that, compared to asset specificity and environmental uncertainty, behavioral uncertainty has received less attention by academics, something reflected also to the far fewer number of efforts to operationalize it (Rindfleisch & Heide, 1997).

### **3.3.4 Uncertainty and the European downstream oil sector**

The construct of uncertainty in TCE was described as consisting of Environmental and Behavioral uncertainty. Now, the analysis of how well can uncertainty of TCE describe characteristics of the European downstream oil sector, will start with environmental uncertainty.

#### *Environmental uncertainty*

This type of uncertainty comprises four different elements; the unpredictability of the environment, the demand volume uncertainty, the technological uncertainty and finally, political uncertainty. The

starting point of the analysis will be the unpredictability of the environment of the European downstream oil sector.

- **Unpredictability of the environment**

An important development which took place over the recent years and illustrates the unpredictability of the environment the European downstream oil sector faces, is the shale oil and gas revolution in the US. Shale gas technology was not something unknown, but the rapid pace of development and adoption of this technology in North America was something which was difficult to be predicted. IEA (2012) refers to various reasons for which forecasting the production of (mainly) shale gas in North America is very difficult. As a matter of fact, production of shale oil and gas in North America has exceeded previous expectations (IEA, 2012); (IEA, 2011). This meant that it was also difficult for European refiners to predict the rapid growth of competition from their U. S. counterparts who, due to shale revolution managed to drastically reduce their operating costs. Hence, U.S. refiners became a serious threat for European refiners, as they started producing cheap gasoline for their domestic market, which in turn decreased the US demand for imports of gasoline produced in Europe. Furthermore, US refiners imposed serious competition for European refiners in the global gasoline markets, and all these developments took place in an unexpectedly short time period (in relative terms for the refining sector). The shale gas and oil technologies revolution in North America had a great impact in the business of trading firms as well, because new supply and demand patterns emerged between mainly the US, Europe and the rest of the world.

- **Demand volume uncertainty**

The European downstream oil sector is characterized by increased demand volume uncertainty. Some serious reasons are to blame for this:

- **Competition:** This argument is mainly related to European refiners, who have to face increased competition in the European and global oil market products from their counterparts in the US, Russia, Middle East and Asia. Refineries in Europe are facing decreasing demand for their products, not only in the European market, where in many cases cannot support, as they cannot produce adequate middle distillates, but also in their traditional global gasoline export markets. A large part of this decrease in demand can be attributed to the competition they face, especially from refineries in the US and Middle East. Moreover, new refineries are under construction in Asia and Middle East, with many of them being export oriented, so competition will become even stiffer. Additionally, the modernization of the Russian refining sector will enable Russian refineries with the necessary equipment to start producing more high quality fuels (including middle distillates) and subsequently exporting them in in the European market, which in turn will put more pressure on European refiners (Fattouh & Mallinson, 2013). As all of these competition-related developments take place, it is obvious that they make forecasting future demand volumes, not an easy task for European refiners. To make things worse, the future turnover of European refineries may be affected not only by the sales-volumes uncertainty, but also by the lower market prices for certain refined products. The market experiences an oversupply of specific products, such as gasoline, due to the increased production from both European refiners and their competitors, which in turn leads to lower prices for these products and further erodes the profits of the gasoline-heavy refineries in Europe.

- **European regulatory framework:** There are several issues related to European legislation which should be analyzed in order to understand how legislation can be a contributing factor to increased demand uncertainty. At first, there are the “green” fuels mandates of the European Commission, such as the requirements for the increased use of bio-fuels in the transport fuels mix. Bio-fuel production is completely by-passing the oil refining sector and hence, the more these fuels are adopted in the fuel mix, the less will be the demand for oil fuels. Next to the increased share of bio-fuels in the transport-fuels mix comes the general fall of demand for conventional fuels in Europe, considering the increasing efficiency of car engines and the substitution effect due to the increased use of electricity in the transport sector. The combination of the previous factors is inhibiting predictions about future fuel demand level and hence, contributes to the high demand volume uncertainty the European refining sector faces. It is not only the European environmental policies which matter though. Fiscal policies also play a crucial role, as the different levies on fuels in some European countries like France and Spain, are significantly affecting the patterns of demand for the respective oil products. As these policies may change in different ways in many European countries, the demand patterns will also change with them. Without certainty about how these policies may be differentiated, it is very difficult to foresee how the future demand patterns for different fuels will look like.

The same demand volume uncertainty which creates a difficult environment for European refiners, as they are unable to forecast the future demand levels for specific oil products, creates business opportunities for trading companies. The more demand is fluctuating for different oil products across different regions, the higher are the chances for the creation of trading and arbitrage opportunities to be exploited by commodities trading firms. As a matter of fact, the business of trading companies is characterized by demand volume uncertainty also in terms of crude oil trading, where as it was discussed in Chapter 2, there has been a decreasing production of certain crude oil qualities and increased availability of heavier and sourer qualities. Many refineries have been incapable process the new crude oil qualities and hence demand for lighter, sweet crudes is higher, which makes them being traded at premium prices. However, several European refiners have been undertaking modernization programs with the goal to enable their plants to process a wider range of crude oil qualities. The increased future crude slate flexibility of these refineries will be translated to higher demand volume uncertainty for the different crude oil qualities, currently being traded in the market.

- **Technological uncertainty**

This type of uncertainty is not really suitable to describe the nature of the European downstream oil sector. The reason is that the pace of technological changes in the downstream oil industry is quite low. The technologies for processing crude oil, for transporting and storing crude and oil products are quite well-known and mature. Therefore, the probability of unexpected changes in technologies used in the industry is quite low, translated to low technological uncertainty (Chen & Chen, 2003). This practically means that this element of uncertainty is not very applicable when it comes to describe the downstream oil sector, therefore it will be discarded from the rest of the analysis.

- **Political uncertainty**

Political uncertainty has a strong presence in the European downstream oil sector. Of course, political uncertainty in most European countries usually would not be translated into risks of outright expropriation of firms' assets by governments. This extreme direct form of political uncertainty is unlikely to be present in most European countries, where there are democratic regimes and markets are considered to be competitive. On the contrary, in Europe there is another type of political uncertainty present, namely the uncertainty related to adverse changes in taxation and other regulatory policies. There is, for example, increased political uncertainty due to the potential intervention of the European governments for purposes related to fiscal and environmental policies. Therefore, the policies related to the different levies on fuels can change and with them, the demand for different types of fuels will change. Moreover, European Commission mandates for bio-fuels, refineries emissions and fuel quality standards are also having a great impact on the profitability prospects of European refiners. However, the problem is that there is uncertainty about future changes in these policies and the impact they will have on the market (Meijknecht, Correljé, & van Holk, 2012). Hence, it is obvious that deciding for future investments in the European downstream oil sector is a task becoming more and more challenging within such an uncertain environment.

In the trading business, political uncertainty is also present in the form of regulatory changes in derivatives-trading environments. These changes are driving up financing and transaction costs for traders but they are also creating business opportunities for asset heavy traders, especially as banks scale down their commodity-trading activities (Ascher, Laszlo, & Quiviger, 2012). Nevertheless, political uncertainty for trading firms in Europe may also be present in the form of potential government interventions in commodities markets, in an effort to influence commodities prices (Pirrong, 2014).

### ***Behavioral uncertainty***

Behavioral uncertainty is the second important dimension of the construct of uncertainty, along with environmental uncertainty. Despite of its theoretical importance though, it is not believed to be useful for describing the characteristics of the European downstream oil sector. The reason is that it is not difficult to measure performance of contracting partners involved in the business. The European downstream oil market is an open, relatively competitive market, where measuring performance of a transaction partner after a contract has been signed, is not usually a problem. This doesn't mean that the transaction partner will necessarily comply with the terms of the contractual agreement, but behavioral uncertainty refers to the difficulty to measure its compliance, which is considered to be low. Hence, since behavioral uncertainty is not very present, the author of this thesis believes it should be discarded from the rest of the analysis.

### ***Conclusion about uncertainty in the context of the European downstream oil sector***

The previous discussion revealed that not all different dimensions of uncertainty are useful in order to describe the nature of the European downstream oil sector. Hence, behavioral uncertainty and technological uncertainty are excluded from the rest of the analysis and therefore, Figure 10 – illustrating all the dimensions of uncertainty as proposed in the TCE framework– is transformed to the following one.

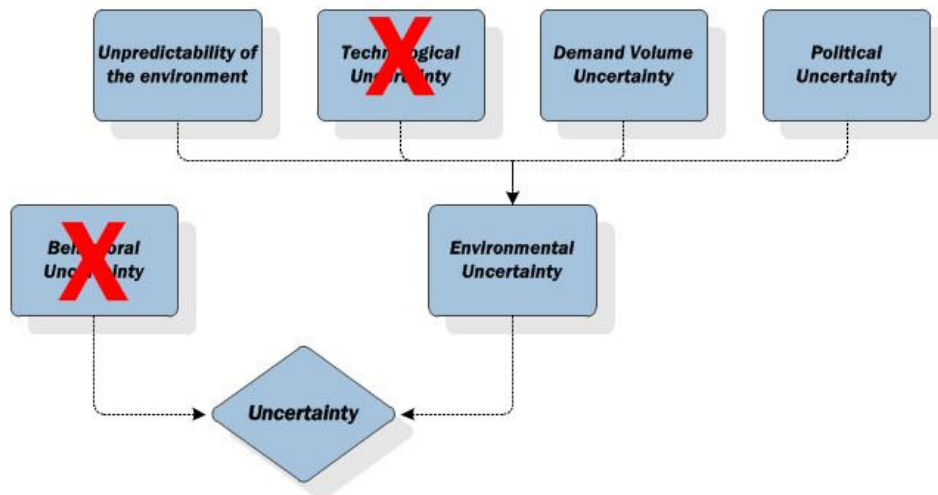


**Figure 11: Relevant dimensions of uncertainty in the context of the European downstream oil sector.**

### 3.3.5 Transaction frequency

This construct refers to the extent to which transactions recur (Geyskens, Steenkamp, & Kumar, 2006); (Williamson, 1985). Williamson (1985) argues that high transaction frequency works as an incentive for firms to employ hierarchical governance, because the overhead cost of this type of governance will be easier to recover for recurring transactions. Transaction frequency is in general a construct that has received limited attention from academics and this has led many researchers to disregard transaction frequency from their analyses (Geyskens, Steenkamp, & Kumar, 2006); (Rindfleisch & Heide, 1997). Moreover, according to Rindfleisch & Heide (1997), many scholars have been unsuccessful in their efforts to confirm the hypothesized effects of transaction frequency on the mechanism of governance chosen, in the sense that they have not been able to find any positive association between transaction frequency and hierarchical governance.

### 3.3.6 Transaction frequency and the European downstream oil sector

It is important to stress again that transaction frequency has received far less attention from the academic community and even its validity has not been proven (Rindfleisch & Heide, 1997); (Geyskens, Steenkamp, & Kumar, 2006). This fact makes the author of the thesis quite skeptical about inclusion of this construct in the frame of the analysis of the European downstream oil sector. Moreover, firms involved in the downstream oil business in Europe are involved in recurrent transactions very often, but still this hasn't led to an industry of only vertically integrated firms, as the theory would predict. On the contrary, there are many oil companies involved in only a part of the downstream oil business (such as independent refiners). Moreover, many companies perceive instead of downstream vertical integration, vertical disintegration in Europe as an attractive option, which can be partly attributed to the emergence of a large numbers of trading companies that have facilitated liquid and competitive markets for both crude and oil products (Pirrong, 2014). This development makes, according to TCE, market transactions more efficient than transactions carried out internally and hence, vertical disintegration will be the norm. Since competitive markets exist, even if transactions are recurrent, no impetus for internalization of these transactions exists. Furthermore, it is obvious that the business model of trading companies includes recurrent transactions in its very nature; nevertheless, trading

companies are not largely vertically integrated. Even if some crude oil and refined products traders are acquiring assets such as refineries and are, thus, becoming more vertically integrated, this is not the case for all crude oil and refined products traders in the European downstream oil business.

Conclusively, the construct of transaction frequency, apart from not being sufficiently investigated and proved from the academic and business worlds, it is definitely not a suitable tool to be used for understanding specifically the nature of the European downstream oil sector. Therefore, it is believed by the author of the thesis that it should be discarded from the rest of the analysis.

### 3.3.7 Information asymmetry

Williamson (1973); (1975) has identified “information impactedness” -partly an information asymmetry problem- as one of the main constructs of TCE. Information impactedness is the situation where there is a party negotiating a contract, which has more information than the other parties in the same negotiation. Next to this, it is also very costly for the party with less information to access more information and achieve information parity (Williamson, 1973). In general, TCE recognizes that many economic exchanges are characterized by incomplete, imperfect or asymmetrical information. In the case of incomplete information, all parties involved in a transaction face the same incomplete level of information and thus they perceive the same levels of uncertainty. However, in the case of asymmetrical information, there is public information available to all parties, along with private information available only to certain parties, which eventually realize higher levels of information (Hobbs, 1996). Consequently, it should be apparent that yet again, opportunistic behaviors may emerge from the parties which possess undisclosed information (Williamson, 1973); (Williamson, 1975); (Hobbs, 1996).

This opportunism may emerge in two different ways; the first is the ex-ante (a transaction) opportunism and the second is the ex-post (a transaction) opportunism. In the first case, the information asymmetry between the parties might lead to a typical adverse selection problem (Akerlof, 1970); (Williamson, 1973); (Hobbs, 1996); (Rindfleisch & Heide, 1997). This is the typical case where a seller of a product has information about defects in the product, that is not available to the buyer of the product (typical example is the second-hand cars). In these cases, the seller may act opportunistically and avoid revealing this information to the buyer, prior to the transaction, in an effort to sell the product at a higher price than it would achieve if there would have been information parity between the two parties (Akerlof, 1970); (Hobbs, 1996). In the case of TCE, ex-ante opportunism problems stemming from information asymmetry are often related to the difficulties in ascertaining the other parties’ true characteristics prior to a transaction. Such a situation may give rise to transaction costs in the form of selection and screening efforts aiming to identify appropriate exchange partners before a transaction takes place (Rindfleisch & Heide, 1997).

The second type of opportunism may occur ex-post the transaction and is related to the difficulty to monitor the actions or performance of other parties. There is information asymmetry between the parties after a transaction has been completed, as some of their actions might be hidden (Williamson, 1973); (Williamson, 1975); (Hobbs, 1996). The author of this thesis touched upon the issue of observing the actions and performance of parties after a transaction has taken place, in the paragraph which is describing behavioral uncertainty. It is obvious that behavioral uncertainty leads to information asymmetry, which in turn increases the risk of ex-post opportunism (Rindfleisch & Heide, 1997). The parties which are aware that their actions are not directly observable by the other parties, may be tempted to act opportunistically and try to maximize their economic welfare (Williamson,

1973); (Williamson, 1975); (Hobbs, 1996). This is the well-described problem of moral hazard and typical examples exist in the insurance market. For instance, once insurance for fire has been obtained, individuals may start taking less care in the prevention of fires, as they know that the insurance company cannot monitor their actions. Moreover, they even might be tempted to provoke some damage in an effort to collect high insurance payments (Williamson, 1973); (Hobbs, 1996).

Nevertheless, Williamson (1975) suggests that information asymmetries in general may not pose a problem and hierarchical governance structure may not be necessary, under certain circumstances. These circumstances exist when the parties involved in a transaction are not opportunistic, when there is unbounded rationality and when there prevails condition of large-numbers competition, both presently and prospectively.

### 3.3.8 Information asymmetry and the European downstream oil sector

The European downstream oil sector belongs in a relatively open, competitive European crude and oil products market. However, it is not a perfect market, as information asymmetries are present. This can be understood from the fact that there still exist arbitrage opportunities, which would not be present by definition in a perfect market. Moreover, there is a strong presence of speculators in the downstream oil business. Well-informed speculators tend to react quickly, even quicker than commercial traders, by buying future contracts in an effort to make profits from expected price changes (Kesicki, 2010). However, only the fact that speculators do exist, and indeed play a substantial role in the market is translated to a market imperfection due to information asymmetries.

Moreover, market asymmetries may exist between crude oil producers and refiners. A refinery must plan its capacity on some assumptions about future crude prices and the availability of crude oil supply. However, this information is widely accessible to the crude oil producer but may not be so easily accessible to the refiner. The crude oil producer, in this case, does not want to reveal this information to the refiner, because of the prospect of extracting higher prices for future crude oil delivery (Al-Obaidan & Scully, 1993). Of course, information asymmetries might exist as well between refiners and traders, where the latter may be more aware of regional price differentials for oil products and local demand requirements, and thus they may be able to make more profitable agreements with refiners.

It is also acknowledged that acquiring storage assets and terminals, and getting more involved in trading, opens opportunities to gain access to exclusive and unpublished market information (Ascher, Laszlo, & Quiviger, 2012), which can help a company to achieve information parity or even create information asymmetries favorable to it.

Another comment is that information asymmetries may exist as well in terms of future regulations and policies. Obviously, oil companies have access to more information about these issues in their home countries, and hence, there is information asymmetry between them and other foreign companies involved in the same market. Additionally, it comes without saying that European NOCs (or otherwise named “National Champions” in this report) enjoy higher levels of information about the future market conditions and the future regulatory regime in their home countries, compared to their competitors in these markets.

To summarize the previous, information asymmetries exist in the European downstream oil sector. Nevertheless, many of these asymmetries have started declining in the recent years due to the development of sophisticated information technology tools and the increased price transparency

offered by market agencies and online platforms, for example such the ones of Platts and Argus (Ascher, Laszlo, & Quiviger, 2012); (Pirrong, 2014).

### 3.3.9 Small-numbers issue

The small-numbers issue is another important aspect of TCE theory and it was highlighted by Williamson (1973); (1975). Williamson identifies that when there is a large number of suppliers who are roughly equally qualified to provide the buyer with a product or service, not only at the time of an initial transaction (contract) but also during all the future contract renewal intervals, then competition will prevail and market governance structures will be appropriate for these transactions. However, when this is not the case and there is instead a small number of suppliers capable to supply the buyer, then the buyer may expose itself to opportunistic behavior of suppliers if the transaction will be performed at a market environment. In these cases the buyers should opt for a more hierarchical governance structure in order to perform the transaction (Grover & Malhotra, 2003); (Williamson, 1975). The important remark here is that the small-numbers issue has also two dimensions: the small-numbers situation ex-ante the transaction and the small-numbers situation ex-post the transaction (Williamson, 1975); (Leiblein, 2003). However, these two categories may exist only in cases where there are recurrent transactions and changing market circumstances and hence, recurrent bargaining between the buyer and the sellers exists. When these conditions are not present, the small-numbers problem is not a serious issue to affect the choice of an appropriate governance mechanism. After all, as Williamson (1975, p. 28) puts it “absent recurrent bargaining, a merger agreement has nothing to commend it over a one-shot exchange agreement. Absent changing market circumstances, an exchange agreement, once reached, can be made to hold indefinitely”. Nevertheless, when these two conditions are present, then an ex-ante and an ex-post small numbers problem may emerge. In the first case, at it should be apparent from the name, there is a small numbers bargaining situation ex-ante the transaction or otherwise stated at the outset of a transaction, which may lead to opportunistic suppliers’ behavior (Leiblein, 2003); (Williamson, 1973); (Williamson, 1975). However, it may be the case that there exists a large number of suppliers at the outset of the transaction. Even though this does not create bargaining problems for the initial transaction, if this transaction has a recurring nature, there is a risk of ex-post small numbers. The reasons the initial large number of suppliers might be transformed into a small number at subsequent time intervals, are that suppliers who will be involved in the first transaction obtain an idiosyncratic experience associated with contract execution, and that there might be future failures in the human and non-human capital markets (Williamson, 1975). Moreover, the likelihood of experiencing ex-post small number bargaining situations increases significantly in cases of economic exchanges that involve significant specialized investments (and hence asset specific investments) (Williamson, 1975); (Leiblein, 2003). It is obvious that almost by definition, as suppliers’ assets become more specialized, the competitiveness of the suppliers market should decrease and thus small-numbers condition will prevail (Walker & Poppo, 1991).

### 3.3.10 Small-numbers issue and the European downstream oil sector

On a general level, there were significant small-numbers issues the downstream oil sector was facing in the past. Penrose (1968) had advocated that oil companies should seek to acquire their own sources of crude oil, if they would otherwise be deprived of a regular flow of supplies or charged monopolistic prices. Another advice from the same author was that oil companies should also try to acquire their

own outlets, if they would otherwise be faced a monopolistic combination among buyers of their product. Therefore, there were indeed small numbers issues in the downstream oil industry.

This is not the case anymore. The markets for crude oil and refined products have become liquid and competitive due to the emergence of a large number of trading firms (Pirrong, 2014). This has mitigated the risk of small number bargaining situations, as there is available a large number of suppliers capable of providing all different types of crude oil and all different types of refined products.

However, there are some situations where small-numbers bargaining might take place, according to the opinion of the author of this thesis. There are cases where the typical condition of a small number of suppliers available to a buyer is reversed and there is a small number of buyers available to a seller of an asset. While this is not the standard description of the small-number situation in TCE theory, it is believed that since problems related to this situation are, in essence, problems of bargaining power, it may well be the case where a seller who is under pressure to sell an asset, would have decreased bargaining power if not many potential buyers for the asset exist in the market. In such a case, buyers can bargain a better agreement, as the seller will be less reluctant to accept selling the asset at a lower price. This situation may emerge within the environment of the European downstream oil sector in cases where there are less profitable old, small refineries, positioned in disadvantaged locations. The owners of these refineries may be in a need to sell them (as it was the case of Petroplus for example), but the specific characteristics of these assets make them less attractive to buyers. Moreover, the option to convert them in storage facilities may not be viable (due to location disadvantages) and even a decision for closure may be hard to take, due to environmental (cleaning-up costs) and political considerations (loss of jobs). When these conditions occur simultaneously, the owner of the refinery has limited options and is more willing to accept a lower price for selling the plant to a potential (and maybe the only one) buyer (Ernst & Young, 2013). This is one more example of a problematic bargaining situation which may emerge due to small-numbers issues in the European downstream oil sector.

Last but not least, in the case of storage facilities, there are obviously well-located and less well-located assets, and they are of a special configuration, meaning that they can only be used for storing specific commodities. It is obvious that a firm which is in urgent need to buy a storage facility with specific characteristics in terms of location and configuration, may have a disadvantage in a bargaining situation with a seller of such an asset. Obviously, the latter party may exploit the uniqueness of the asset it possesses for asking a higher selling price.

### 3.3.11 Governance structures

This is a construct which belongs in the core of Williamson's work on TCE. In essence, governance structures simply refer to the three general types of governance mechanisms mostly acknowledged in the TCE literature: the market, the hierarchy (integrated firms) and the intermediate or hybrid forms (including alliances) (Grover & Malhotra, 2003); (Rindfleisch & Heide, 1997); (Leiblein, 2003). The governance structures, is actually a dependent construct (variable) in TCE theory, where asset specificity, environmental uncertainty and behavioral uncertainty are the main independent constructs (variables) (Rindfleisch & Heide, 1997); (Grover & Malhotra, 2003). The manner through which all the constructs discussed previously can, and should according to TCE, influence the choice of an appropriate governance structure in order to minimize transaction cost, has already been discussed previously. It is interesting however to examine the effects of the highly specific assets and of the

uncertainty in the downstream oil business in Europe, on governance form chosen by firms involved in this industry.

### **3.3.12 The effects of asset specificity and uncertainty on the choice of governance form in the European downstream oil sector**

Decision makers of firms and other organizations which have a stake in the downstream oil business in Europe are characterized by bounded rationality. It is therefore impossible for them to predict for all future contingencies when they make decisions for investments or divestments in the sector and when they arrange transactions with contractual agreements. However, as illustrated in the previous paragraphs, the European downstream oil sector involves assets which are of high site and physical specificity. Moreover, there is also a strong presence of the issue of temporal specificity, especially in the trading business. These are accompanied by increased uncertainty which takes mainly the form of unpredictability of the environment, demand volume uncertainty and political uncertainty. Therefore, as TCE would predict, the combination of the bounded rationality of actors making decisions, with the increased asset specificity and uncertainty present in the downstream oil business in Europe, creates room for opportunism to rise (Williamson, 1971); (Geyskens, Steenkamp, & Kumar, 2006); (Al-Obaidan & Scully, 1993); (Pirrong, 2014). Specific parties in a transaction may thus be tempted to act opportunistically in order to extract higher rents from the other parties. This opportunism goes hand in hand with contracting and bargaining hazards. Fully-contingent contracts are difficult to be made and it is costly to enforce them in cases of non-compliance to their terms. Moreover, investments in highly specific assets may result in changes in the relative bargaining power of the parties involved in a transaction, which in turn may lead to new contractual hazards if or when renegotiation of the initial contract terms will take place.

It is due to the opportunism risk that many companies involved in the downstream oil business have sought to integrate vertically or in other words, opt for a hierarchical governance form. The oil industry is actually a very good example of an industry where there are firms involved only in specific businesses within the oil value chain, there are many (fully) vertically integrated firms like the IOCs, but there do exist as well spot markets and long-term contracts (Correljé & van Geuns, 2011). However, the rationale for becoming more vertically integrated is not only because integration is seen as a safeguard to opportunism, but also because there are other economic considerations taken into account. There are many examples of companies which tried to integrate backward and forward when they realized that rents generated in other segments of oil value chain are high and similarly, exited business segments with low returns (Frankel, 1969); (Penrose, 1968). Al-Moneef (1998) gives a comprehensive analysis of the benefits and the drawbacks that stem from vertical integration for NOCs. He also refers to the different strategies these companies followed with respect to becoming more integrated. Moreover, he pinpoints the role vertical integration has to play for transaction costs as he mentions that “vertical integration in the petroleum industry is (theoretically) supposed to save storage, refinery design, and a broad category of transaction costs. A vertically integrated firm would have the advantage of being able to plan capital investments in different phases with perfect coordination.” (Al-Moneef, 1998, p. 207). Penrose (1968, p. 46) also highlights some of the advantages vertical integration has to offer to a firm involved both in upstream and downstream operations. Such as fully integrated firm would be able to enjoy the advantages of having “... (1) assured outlets for crude, leading to a steadier and more efficient planning of output over time; (2) more efficient operation of refineries as a result of an assured and managed flow of crude oil; (3) a more flexible and efficient adjustment to short-run

changes in the demand for different products in different areas, which can then quickly be reflected in the inflows of crude oil; and (4) a consequent avoidance of disruptive fluctuations in prices which would raise costs to both producers and consumers". All these four considerations are related to transaction costs, as a non-integrated firm will be more vulnerable to opportunistic behaviors of suppliers and buyers of its products. Nevertheless, it is out of the scope of this thesis to fully describe the advantages and disadvantages of a hierarchical form of governance (vertical integration), over the market form of governance and vice versa. The author of the thesis merely wants to highlight the relation between the risk of opportunism and the choice of an appropriate governance form in the oil industry.

Especially concerning the European downstream oil sector, it seems that the vertically integrated model for refiners is severely challenged (A. T. Kearney, 2012); (Ernst & Young, 2012a). Many oil companies were largely integrated as vertical integration was perceived in the past, as a good way to provide a firm a natural hedge against the volatility and riskiness of upstream operations. Integrating the downstream part of the oil value chain was also perceived as providing long-term financial stability and cash-flows, along with market access (Ernst & Young, 2012a). Nevertheless, value creation has shifted significantly towards the upstream segment of the business during the past years, partly due to higher oil prices. At the same time, the returns in the downstream segment have been low or negative, something which created an incentive for largely integrated companies to disintegrate downstream. Additionally, the emergence of a large number of crude oil and refined products trading firms has created liquid and competitive markets, and this practically means that conducting transactions using market structures has become cheaper. This in turn has provided even more incentives for downstream vertical disintegration for many oil companies, not only in Europe, but also in other areas of the world (Pirrong, 2014). In other words, the large number of traders has reduced incentives for crude oil suppliers or for refined product buyers to act opportunistically. The low risk of opportunism combined with the low rents generated in the European downstream oil business, have created an appetite for many major oil companies to disintegrate downstream and withdraw from the European downstream market. These developments can partly explain why many fully vertically integrated firms are exiting from the refining business in Europe. As it was discussed in Chapter 2, the commitment of the major international oil companies to integration has been generally decreasing over the past years, so downstream vertical disintegration is definitely not a solely European phenomenon (Ernst & Young, 2012a).

On the other hand, as it was exposed in Chapter 2, many NOCs are increasingly becoming more vertically integrated and are expanding their presence in the refining sector of their home markets, European markets and other global markets as well (Ernst & Young, 2012a). Therefore, it is obvious that firms involved in the European downstream oil sector are behaving differently in terms of how integrated they are and what level of integration they want to reach. The author of this thesis believes that higher or lower risk of opportunism and subsequent transaction costs, play a decisive role for adopting strategies of backward and forward integration or disintegration. For the years to come, it becomes of the utmost importance for oil firms to choose the right operating model and required level of integration, if they are to improve their margins and sustain profitability in this volatile market (A. T. Kearney, 2012).

Additionally, it is remarkable that there are also some major trading firms (see Chapter 2) which have also followed a strategy of becoming more integrated up to a certain extent, as they have held some small refining assets. These assets are often used as leverage for their trading operations (Ernst & Young, 2012a) and again in this case, possessing these assets lowers the risk of opportunism (such as

strategic hold-ups) the trading companies may face from their suppliers or buyers of crude oil and refined products.

It is expected that at this point, it has become clear how well the construct of governance forms, the dependent variable of TCE, can “fit” within the nature of the European downstream oil sector. Moreover, all the important theoretical constructs of TCE, as well as their appropriateness for this research, have been now discussed. However, there is an important limitation of TCE which constitutes it unable to fully depict the idiosyncratic nature of the European downstream oil sector. This limitation will be highlighted in the next paragraph of this Chapter, along with what can be done to overcome it.

### 3.4 A TCE limitation: Private and public parties' opportunism

It should be obvious by now that there is indeed a high risk of opportunism in the European downstream oil business. The kind of opportunism TCE mainly emphasizes is the one that may emerge due to a private party's self-interest seeking behavior. However, the European downstream oil sector is intrinsically related not only to private entities but also to public entities and specifically governments. Firms involved in the European downstream oil business may have a public or public/private ownership structure, like the NOCs, and thus any opportunistic behavior on behalf of them cannot always be adequately explained merely by TCE. After all, the high site specificity of assets combined with the increased political uncertainty which characterize the European downstream oil sector, give an indication of the substantial role governments can play in influencing the businesses of firms in the sector. Indeed, the European downstream oil sector is not like many other industries; governments are more than present.

Generally speaking, there are numerous examples of state interventionism in the oil business which can be found in the literature. The role of governments in the oil business has been highlighted and analyzed in many cases (Penrose, 1968); (Ellis Jones, 1988); (Correljé & van Geuns, 2011); (Kesicki, 2010). It is true that the focus of many of these analyses is on the upstream oil business, as there are numerous examples in history where governmental intervention took even extreme forms, such as seizure of assets of foreign companies in specific crude oil producing countries. However, state interventionism can be equally found in the downstream oil business (Correljé & van Geuns, 2011). Correljé & van Geuns (2011) presented a comprehensive list of the different types of state interventionism which may take place in all of segments of the oil business. They classified these types of interventions under five categories; (1) The first category includes the most general form of intervention, which involves the establishment of norms and standards in respect of accounting, safety, environmental protection, land use and spatial planning, health impacts, emergency stocks, fuel composition and quality etc. The second (2) category includes intervention in the form of establishment of taxes and levies on specific products and activities, or their subsidization. Other forms of state intervention are represented as outright regulation of activities of the industry (3) or public ownership in the oil industry (4) either with direct control by a Department or Ministry or by ownership of the shares of firms. A final form (5) of state intervention entails specific policies with respect to competition, under which the state seeks to reduce the market power of firms, consortia and cartels. The most common forms of state intervention in the oil industry are presented below.

| Activities in the value chain                                         | Main forms of intervention                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|-----------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Upstream                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Exploration and drilling test wells                                   | <ul style="list-style-type: none"> <li>– Permits and concessions for access to exploration acreage</li> <li>– Exploration levies and fees</li> <li>– Subsidization and support for national firms, exploring abroad</li> </ul>                                                                                                                                                                                                                                               |
| Production of crude oil                                               | <ul style="list-style-type: none"> <li>– Taxation and royalties</li> <li>– Regulation of production capacity</li> <li>– Regulation of well depletion and crude production quota</li> <li>– Local content requirements</li> <li>– Profit sharing</li> <li>– Rules on foreign investments</li> <li>– State ownership and joint ventures</li> <li>– Subsidization and support for national firms, producing crude abroad</li> <li>– Decommissioning of installations</li> </ul> |
| Midstream                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Transport and storage of crude oil                                    | <ul style="list-style-type: none"> <li>– Export quota and taxes</li> <li>– Mandatory use of national shipping</li> <li>– Subsidization</li> </ul>                                                                                                                                                                                                                                                                                                                            |
| Crude refining and product manufacturing                              | <ul style="list-style-type: none"> <li>– Investment controls and local content rules</li> <li>– Regulation of crude purchases (by origin)</li> <li>– Regulation of input prices</li> <li>– Wholesale price regulation</li> <li>– Output quota</li> <li>– State ownership and joint ventures</li> </ul>                                                                                                                                                                       |
| Transport, wholesale and storage of oil products                      | <ul style="list-style-type: none"> <li>– Subsidization</li> <li>– Regulation of mandatory fuel emergency stocks</li> <li>– Regulation of cost and tariffs</li> <li>– Product specifications</li> <li>– Import and export controls</li> <li>– State ownership and joint ventures</li> </ul>                                                                                                                                                                                   |
| Downstream                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Local storage, trading and distribution of products to retail outlets | <ul style="list-style-type: none"> <li>– Subsidization</li> <li>– Regulation of mandatory emergency stocks</li> <li>– Regulation of investments, cost and tariffs</li> <li>– Import and export controls</li> <li>– State ownership and joint ventures</li> </ul>                                                                                                                                                                                                             |
| Retail trade in products                                              | <ul style="list-style-type: none"> <li>– Regulation of locations and market shares</li> <li>– Regulation of mandatory purchasing quota</li> <li>– Subsidization and taxation</li> <li>– Regulation of end-user prices and tariffs</li> <li>– Competitive bidding and licensing of new outlets</li> <li>– State ownership and joint ventures</li> </ul>                                                                                                                       |

**Figure 12: Common forms of state intervention in the oil industry.**

**(Correljé & van Geuns, 2011)**

The focus of this research is on the downstream oil sector, which in the work of Correljé & van Geuns (2011) is named midstream segment of the oil business. The authors comment specifically for this business segment, that past efforts of governments to intervene had mainly two goals; the first was to constrain the market power of the large international oil companies, by imposing an “acceptable” price for their products and appropriating a share of the sales revenues through end-use levies, while the second was to promote the construction of “national” refineries for strategic and economic reasons, as well as for increasing independency from imports of fuels. It is therefore obvious that state interventionism is not negligible in the downstream segment of the oil business. The European downstream oil sector is not an exemption, even though it may be less susceptible to state intervention compared to downstream sectors in non-European markets.

To conclude, the state ownership of many oil companies and the increased potential for governmental interventions in the European downstream oil business, are factors which render traditional TCE framework inadequate of describing the opportunistic behavior of all actors in the business. Since TCE and Williamson can better explain the opportunism of private parties, the theory should be complemented to take into account the opportunism of public parties as well. This is where Spiller’s

(2011) TCR framework comes into the picture, as it is specifically referring to the types of opportunism that may emerge when there are interactions (transactions) between private firms and public entities, such as governments.

### 3.5 Transaction Cost Regulation

Spiller (2011) has proposed the Transaction Cost Regulation (TCR) framework, which aims to understand the governance features of the interaction between governments and private investors “fundamentally, but not exclusively, in utilities sector” (p. 3). TCR emphasizes regulation as the governance structure of these interactions and tries to understand the organizational impact of their inherent contractual hazards. The author states that since the emphasis of TCR is on contractual hazards, this asks for assessment of real behavior, by real people in real environments within real institutions. Therefore, Spiller pinpoints, even though politics is usually not necessary to understand private contracting, it becomes fundamental to understanding regulation as the governance of public/private interactions.

Since the focus is on utilities sector, Spiller (2011) discusses the TCE approach and refers to the features of TCE which Williamson has identified as relevant when it comes to evaluate alternative modes of organizing natural monopoly supply. Subsequently, Spiller reclassifies these features into two categories. The first category is called transaction cost considerations, and includes (1) the level of available technology, (2) the demand uncertainty, and (3) specific investments/skills. The second category is called political considerations and includes (1) consumer preferences aggregation, (2) efficacy of scalar bidding, and (3) political opportunism. These two categories are then directly associated with the two fundamental pillars of TCR, namely Transactions Cost Economics and positive political theory. TCE and positive political theory complement each other, as the former helps understand governance mechanisms through emphasizing on transaction hazards, while the latter helps understand the full extent of the hazards associated with public/private interactions by highlighting the political dynamics inherent in these interactions.

It becomes therefore apparent the crucial role political considerations have to play in Spiller’s framework. However, the actual constructs of his framework have not yet presented. These are the following two: Governmental opportunism and Third-party opportunism. These types of opportunism may emerge in the utilities sector, which Spiller considers as having three important characteristics. The first is that the sector is characterized by specific investments (high level of physical specificity), a high component of which is sunk investments. The second is that the sector experiences significant economies of scale and scope at the relevant levels of demand. Finally, the third is that there is widespread domestic consumption of what the sector is producing. These three characteristics, Spiller claims, are at the epicenter of the contracting problems that have traditionally deteriorated government and utility investors’ relations, and make the pricing of utilities an inherently political issue. The analysis will focus next on the two main constructs of the TCR framework, the governmental and third-party opportunism.

#### 3.5.1 Governmental Opportunism

Governmental opportunism has its roots in the ability of governments to change the rules of the environment by using their standard powers to extract the quasi-rents of utility investors (Spiller,

2011). There are two ways governments can follow for changing these rules; firstly they can issue legislation (law, decree or municipal decision) making illegal a particular type of conduct, contract or pricing, even one it may have originally promoted or formally agreed to. Secondly, they can opt for the use of administrative processes, such as the imposition of fines for alleged quality deficiencies or the denial of a tariff increase through a regulatory decision. Spiller presents several examples of extreme governmental opportunism. In these examples it becomes clear that, apart from the formal powers (regulatory decisions, legislative acts, executive decrees, attorney general recommendations, judicial decisions) governments possess in their armory, there are also informal powers such as press releases, ombudsman's letters, public announcements and other, which they can use to achieve their goals.

Obviously, in an environment where there is high risk of governmental opportunism investors will either avoid investing or will demand up-front compensation for that risk. What is interesting, however, is that not only private investors but also public operators might be affected by governmental opportunism. This is possible due to the governmental direct control over publicly owned companies, which, in fear of governmental opportunism, may take measures to protect their cash flows. Such measures may include hiring too many permanent or transitory employees, granting excessive benefits or other similar actions, which will eventually result into low efficiency and quality of product or service levels.

An important remark at this point is that the sunk investments inherent in the nature of the utilities sector, actually augment the risks and hazards from governmental opportunism. The reason is that, once investments are sunk, an incentive emerges for politicians to behave opportunistically towards the investing company. As Spiller puts it (2011, p. 11) "sunk investments expose the utility to the risk of potential expropriation". However, there are even more hazards for a utilities operator due to governmental opportunism. Since the investments are sunk, utilities operators will be willing to continue operating as long as their operating revenues exceed operating costs. So the operating company will be willing to operate even if prices are below average costs, something which governments may take advantage of. Another issue is that due to the strong economies of scale and scope, there will be only a few suppliers serving the market, which increases the concerns of operators for a potential monopoly if governmental actions will allow for it. Last but not least, the widespread consumption of utility services makes control of utility pricing a very valuable instrument for political purposes.

To conclude with governmental opportunism, there is a need to highlight that Spiller's framework considers political actors as normal economic agents who will behave opportunistically if given the opportunity. Thus, regulatory environment does not solely exist for accommodating the conflicting private interests of actors who behave opportunistically. On the contrary, this environment is interacting with the private parties and it is changing continuously, driven by the opportunistic behavior of political actors. This leads Spiller to suggest that regulatory policy making should not be driven only by considerations on how to restrain firm opportunism and their market power, but it should also be taking into account the ways to provide incentives for private investments by restraining governmental opportunism as well.

### 3.5.2 Third-party opportunism

Where there are interactions between governments and private entities, like in the case of the utilities sector, there are usually third-parties monitoring the interactions. These parties may be supervised by

other third-parties as well. For example, regulatory agencies in the U.S. are supervised by congressional committees, which in turn are influenced by other interested third-parties. All of these third-parties have specific interests and they may very well behave opportunistically. When there are interactions between governments and utilities operators, third-parties may have incentives to question the probity of the interaction, which means that they are also affecting directly the perceived probity of the public agent in charge. Their incentives for questioning the probity of the public agent may be related to competition with this agent in the political arena, but may also be of an economic nature. In both cases, displacement of the political agent in charge may be involved. From a political perspective, the third-party will consider a success the replacement of the retiring agent by an agent related to it or at least by an agent with similar interests. From an economic perspective, the third-party will consider a success a replacement of the private utility operator or a change in the terms of the contract or in the dimensions of the utility's conduct, in ways that benefit the third-party.

This kind of third-party opportunism, especially from a third-party with increased credibility, may turn out to be very costly for the public agent (in a competitive political environment). The costs may vary from simply time and money expenses in order to defend its actions, up to even legal prosecution.

An important distinction between governmental and third-party opportunism, is with regard to the necessary circumstances for their emergence. While governmental opportunism asks for sunk investments, third-party opportunism is relatively independent of their presence and does not specifically depend on any kind of investments. On the other hand, the public agent's political capital can be an important factor which may create room for third-party opportunism. A public agent with short political life expectancy will be facing lower risks of third-party opportunism, than an agent who is larger, more visible and has better organized opponents.

### 3.5.3 A final conclusion about governmental and third-party opportunism

The previous analysis shed some light on the risks of governmental and third-party opportunism. A final conclusion highlighted by Spiller (2011), is that these two types of opportunism are likely to arise in different environments. In a case where there are few institutional limitations to governmental discretion the environment resembles a "natural" state, and it is under these circumstances where governmental opportunism thrives. On the contrary, third-party opportunism is less likely to emerge in such an environment due to exactly the same discretionary ability a government has. This type of opportunism will most likely arise in an environment where this ability is constrained, such as in an "open access" state environment.

Spiller (2011, p. 25) also mentions that the effort to adapt regulatory responses to hazards "would require paying more attention to procedures in environments more prone to third-party opportunism, while environments characterized by the threat of governmental opportunism would require more attention to limiting regulatory discretion. When these adaptations cannot be easily implemented, then, vertical integration, i.e., public ownership, would be the norm".

## 3.6 Transaction Cost Regulation and the European downstream oil sector

Spiller (2011) referred to the governmental and third-party opportunism issues, which may emerge in the utilities industry. He emphasized the three unique characteristics of the utilities sector, which include specific investments which are sunk, the presence of economies of scale and scope, and finally a

widespread domestic consumption of what the sector is producing. The author of this thesis believes that these characteristics can be found as well in the downstream oil sector; therefore TCR framework can also be applicable in this case.

At first, it is true that the downstream oil industry is indeed characterized by highly specific assets and hence, the investments for these assets are also of a specific nature. Moreover, these investments are sunk, as it was explained in the paragraph which describes the site specificity of the assets of this industry. Obviously then, the utilities and the downstream oil sectors are very similar in this respect.

Then is the presence of economies of scale and scope. Alike the utilities sector, the downstream oil sector exhibits strong economies of scale at the relevant level of demand. This is because one large refinery, if well located and with good logistics infrastructure, can sufficiently serve the needs for oil products of a wide geographical region. Moreover, there are economies of scope present as well, as investments in specialized units give the opportunity to produce more than one specific refined product. For example, by installing a hydrocracking unit, a refinery can produce diesel, kerosene, jet fuel and other products (Ellis Jones, 1988). Another example is when a refinery invests in petrochemical production units, where again a whole family of products become feasible to be produced. Additionally, assets such as storage facilities also benefit from substantial economies of scale at efficient scale, and for this reason these assets can be geographically dispersed with a small number of facilities serving efficiently the commodity flows for a large region (Pirrong, 2014).

The third characteristic of the utilities sector is that there is widespread domestic consumption of what the sector is producing. This obviously stands as well for the downstream oil sector, in the sense that refineries are producing oil products which are widely consumed for transportation, heating, chemicals production and other purposes. Of course, what many European refineries are producing currently is not exactly what the European market demands and consumes (middle distillates). Nevertheless, middle distillates are imported from outside of Europe, with their flows being handled largely by traders who operate storage facilities and terminals in the region. These assets are also part of the European downstream oil sector, so even though traders do not “produce directly” middle distillates, they do it indirectly by supplying the market with these products. To return to the European refineries, they can, in any case, be upgraded and become capable of producing what the market of their home country widely consumes. After all, what Spiller (2011) identified as a potential problem when there is increased domestic consumption of a product supplied by a utilities company, is that there is a great incentive for politicians to try to control the price of the product for political purposes. This is something that has happened in the past also in the downstream oil sector (Correljé & van Geuns, 2011) and may happen again. There are still examples of refineries in European countries operated by NOCs, which largely provide with oil products their domestic markets and in these cases, the probability of state interventions for controlling the refined products prices is higher.

To conclude about the similarities of the utilities sector and the downstream oil sector, it is obvious that the natures of these two industries share many common characteristics. Frankel (1969, p. 140) early on discussed about the possibility to consider the oil industry in general, as a “Public Utility”, and he concluded positively about it. Moreover, he highlighted that the oil industry is characterized by natural tendency to concentration, integration and cartelization, and in the end it is an industry which has many attributes of a natural monopoly (1969, pp. 127-129). This argument makes it apparent that indeed the oil sector (specifically the downstream oil sector in this case) and the utilities sector, are of a sufficiently similar nature to allow the author of this thesis to consider TCR framework applicable to both

industries. Reasonably, the next step is to focus on the two main constructs of TCR and on how well they can be used to describing some of the characteristics of the European downstream oil sector.

### 3.6.1 Governmental Opportunism and the European downstream oil sector

It is true that there is always risk for governmental opportunism in the European downstream oil sector, as the investments of private firms may be sunk and related to specific assets. When this is the case, a typical “obsolescing bargain” situation may arise (Stevens, 2009). This term was first coined by Vernon (1971) to describe a situation where a company proceeds to investments and once these become sunk and operations begin, relative bargaining power switches to the government from the company. Then the government may be tempted to try unilaterally to extract a higher share of the rent generated. Although Vernon (1971) used this term to describe the nature of relations between firms and governments engaged in upstream oil agreements, Stevens (2009) demonstrated that it can be used for describing transit (pipelines) agreements as well. However, as Stevens explains, pipelines agreements are particularly vulnerable to the “obsolescing bargain” because of their cost structures and physical inflexibility, as they are characterized by economies of scale, high fixed costs and low variable costs. It is then the case where the operator of such assets will keep operating even at a loss, so long as the variable costs are covered and some contribution is being made to fixed costs. This is exactly what a government knows and may try to exploit by asking for a higher share of the rents, as the company-operator will keep running the business at a loss rather than shut it down, because closure would still entail high fixed costs (Stevens, 2009). It seems therefore that the nature of assets such as pipelines is very similar to the one such as refineries, which are characterized by the same economies of scale, high fixed and modest variable costs. Hence, refiners would also keep operating as long as they cover their variable costs (Frankel, 1969); (Correljé & van Geuns, 2011). It becomes now apparent that the “obsolescing bargain” may very well take place in interactions between firms and governments involved in the European downstream oil sector and especially the refining sector. An important remark at this point is that, as Spiller (2011) explained, governmental opportunism may arise also when the government itself owns (part of) a firm involved in the business. Additionally, having the governments as shareholders constrains many firms’ investment and production decisions, because there are political and economic factors which determine the ultimate allocation of revenues and not indispensably the needs of the industry (Al-Moneef, 1998).

To summarize the previous discussion, it is the presence of large sunk investments and highly specific assets, the presence of economies of scale and scope, the widespread consumption of refined oil products and the uncertainty surrounding the sector, that all combined may lead to “obsolescing bargain” situations and governmental opportunism. Since the European downstream oil sector possesses all of the previous characteristics, it is also vulnerable to governmental opportunism which comes in addition to the opportunistic behaviors of private parties involved in the sector.

Firms cannot mitigate the risk of governmental opportunism by merely choosing the right governance form, as it is the case of opportunism from private parties. Moreover, the threat of governmental opportunism will make private firms reluctant to invest, unless particular safeguards are in place (Spiller, 2011). These safeguards, Spiller (2011) argues, are essentially a solid regulatory framework which stipulates price setting and conflict resolution procedures (arbitration or judicial), investment policies, quality controls and so on. It is crucial though that these regulations are perceived to be credible enough, in the sense that they cannot be easily by-passed by the government and that the government’s discretionary interpretation of the regulation is limited. In the case of the European

downstream oil sector, is it true that there is a regulatory framework from the European Commission, but every state in Europe has also its own national-level regulations and these may very well differ. Moreover, there are European countries which in any case do not belong in the European Union and hence the regulatory environment there differs by definition in every country. Private firms can always then take into account these differences in the regulations between different countries and decide upon investments where they think the risk of governmental opportunism is lower. On the contrary, firms which have a public or semi-public ownership structure are subject to governmental opportunism in their home countries but it is something they cannot change or mitigate. Obviously, if these firms have a presence as well in non-domestic markets, they can always decide where the regulatory framework works as a proper safeguard to governmental opportunism, and allocate their investments accordingly.

An important comment at this point is that governmental opportunism as described above can be linked to the political uncertainty construct of TCE. According to the point of view of the author of this thesis, increased political uncertainty is translated to increased risk of governmental opportunism. When there is political uncertainty in a specific country, a firm is not in place to predict how taxation or regulation will change and affect (negatively) its business, as the government of that country may attempt to extract more value from its transactions with the firm, given the opportunity. There is therefore an increased risk for governmental opportunism and the private firm will be subject to this opportunism, if it cannot easily relocate its operations outside of this country because of sunk investments and fixed assets. This is particularly the case for many firms involved in the European downstream oil sector because of the increased site specificity of their assets. The necessary precondition for a situation where there is increased risk of governmental opportunism, is a regulatory regime which does not constrain governmental interventions in policies. Such a regime creates an environment characterized by unpredictability of governmental behavior or in other words, an environment of increased political uncertainty.

### 3.6.2 Third-party opportunism and the European downstream oil sector

Spiller (2011) also argues about the problems that may arise from third-party opportunistic behaviors. Problems of this nature are also likely to appear in the European downstream oil sector, as there is a multitude of stakeholders involved with different goals and different power. The word third-party refers to actors which are not directly involved in a transaction or interaction between a government and a private firm. Potential third-parties may be competitors from the same industry or other industries (renewable technologies industry for example) and other private firms of all kind and stakes, as well as their associations. Additionally, potential third-parties can also be the ones not representing (directly) private interests, such as local societies, environmental NGOs, trade unions etc. Since national refineries and distribution systems are often perceived as strategic assets, especially in times of international conflict (Correljé & van Geuns, 2011), it is quite tempting for third-parties to challenge the probity of an agreement between governments or public entities and private firms involved in the sector, in the name of national security of oil products supply or national energy security in general. Of course, there may political or economic considerations, or both of them, behind the actions of the third-parties. Nevertheless, the fact remains that the European downstream oil industry may be subject to opportunistic behaviors of private firms, governments and other public entities, and finally of other third-parties with an interest to change the status quo.

Third-party opportunism may turn out to be harmful for both the private firms involved in the downstream oil business, but also for the public agents who interact with these firms. What Spiller

(2011) proposes for mitigating the risk of third-party opportunism is formalization of the relation between the private and public agent, where every item in a regulatory contract is explicit and highly specific. Moreover, these contracts should be designed so as to limit potential challenges, both at the signing and implementation stages. If the previous conditions occur, then regulatory contracts will tend to demand relatively simple compensation schemes, constrain high volatility in cash flows to the investor and finally, include rigid procedural processes which may, for example, include formal procedures for renegotiation. It is apparent therefore that firms involved in the European downstream oil sector may be subject to third-party opportunism, if they do not take into account the aforementioned consideration when they interact with public entities. Third-party opportunism is more likely to arise in European countries where there is a solid regulatory framework which limits the risk of governmental opportunism, but at the same time limits the power of public agents to control or eliminate the threat of challenges from third-parties. Hence, companies are faced with a trade-off where if they decide to invest in countries where the risk of governmental opportunism is low, the risk of third-party opportunism may be high and vice versa. These considerations highlight how essential is for companies involved in the European downstream oil sector, to employ cautiousness when they are faced with investments decisions in different European countries with different regulatory frameworks.

### **3.7 A new theoretical framework suitable to describe the European downstream oil sector**

The arguments discussed in the previous paragraphs allow for changes in the traditional TCE framework, when it comes to describe the nature of the European downstream oil sector. A new framework combining elements from both TCE and TCR, is believed to be more capable to describe this sector, and in the end, to help answering the first research sub-question of this thesis.

The initial TCE framework, as it was described previously in this Chapter, argues that in an environment where there is bounded rationality and actors will behave opportunistically if given the chance, transactions between actors (firms) may be accompanied by transaction costs. These costs are more likely to arise in the presence of highly-specific assets, uncertainty and transaction frequency. Moreover, small-numbers situations may also increase transaction costs, alone or in combination with information asymmetries in the market. Then, the level of these transaction costs will determine which type of governance –market or hierarchy– is more cost-efficient for a firm, in order to perform the respective transactions. Last but not least, a small-numbers situation can also directly, or in combination with information asymmetries, increase the risk of an opportunistic behavior by a transaction party, which in turn will lead to higher transaction costs.

The author of the thesis is now proposing a differentiated version of the previous framework, which incorporates the key points of the discussion in the previous paragraphs and is specifically meant for describing the European downstream oil sector. The old and the new frameworks are illustrated in the following figure.

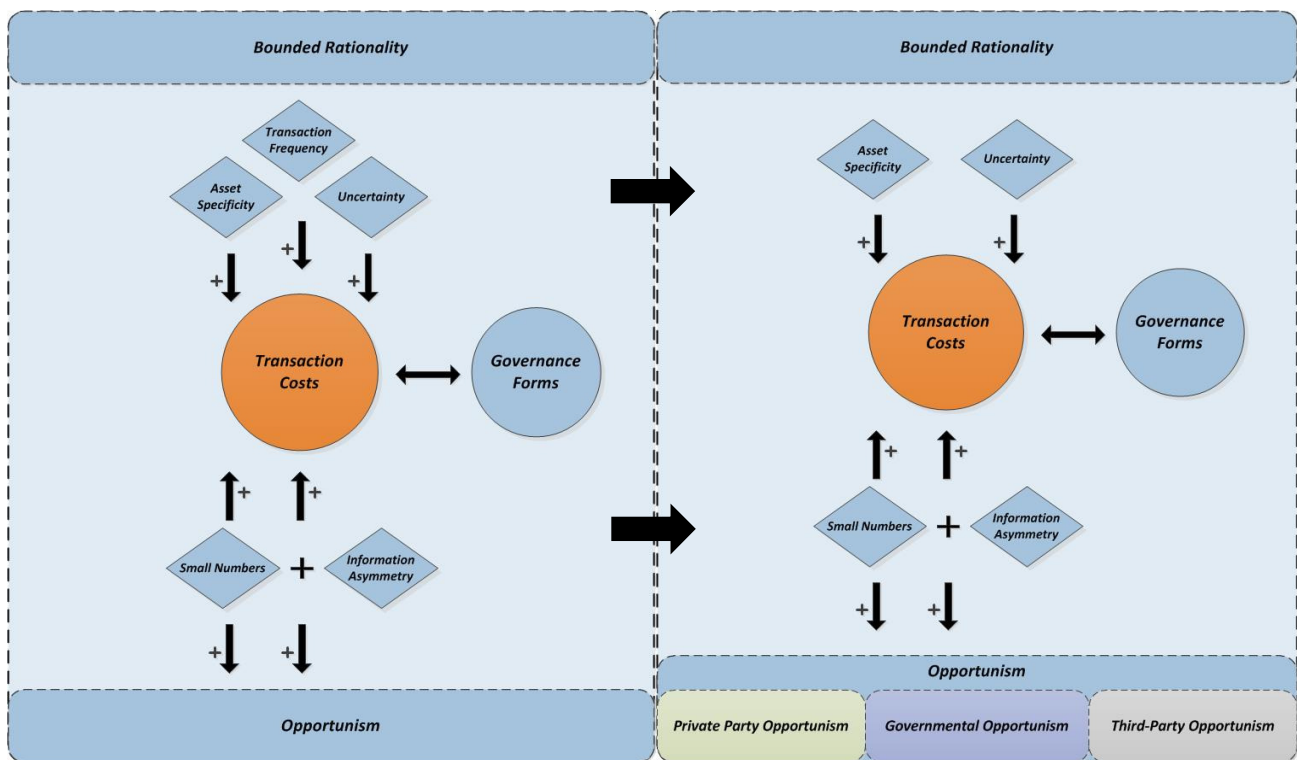


**Figure 13: The original TCE theoretical framework (left) and the new theoretical framework proposed in this thesis (right).**

The new framework maintains the two basic assumptions of TCE, namely the bounded rationality of decision makers involved in the European downstream oil industry and the notion that given the opportunity, actors will behave opportunistically. However, in this case, transaction costs may arise only due to the presence of specific assets, uncertainty and small-numbers situations, combined or not with information asymmetry. Therefore, the construct of transaction frequency has been removed because it is inapplicable to the European downstream oil sector (see paragraph 3.3.6). Moreover, although not explicitly illustrated in the figure, asset specificity and uncertainty comprise only of some of their elements (see paragraphs 3.3.2 and 3.3.4). Again, transaction costs can influence a firm's choice for a hierarchical or a market governance structure. However, concerning the assumption of opportunism, the focus is on the European downstream oil sector, meaning that firms involved in this business face the risk of opportunistic behavior by their exchange partners in three ways. The first is the risk of opportunism by a private party, adequately explained by traditional TCE; the second is the risk of governmental opportunism explained by TCR and the political uncertainty construct of TCE; the third the risk of an opportunistic behavior of a third-party explained by TCR. Small-numbers situations, alone or in combination with information asymmetries, can again increase the chances of an opportunistic behavior by an exchange party in a transaction, be it a private, public or third-party.

### *Answering the first research sub-question*

The updated theoretical framework is considered to be an adequate preliminary answer to the first research sub-question:

*“How well can a combination of TCE and Spiller’s TCR theoretical framework describe the unique characteristics of the European downstream oil sector and help research in a systematic manner the drivers behind corporate decisions for investments or divestments in this sector?”*

The new theoretical framework allows for describing in a detailed manner many of the characteristics of the sector. The explanatory power of this framework will be also tested against the results of the Q methodology research which follows in subsequent Chapters, and in this way, a definitive answer will be given to the first research sub-question.

## **3.8 The rationale behind the use of theory in order to describe the European downstream oil sector**

At this point, the author of the thesis would like to draw the attention of the reader to the reason behind the effort to try explaining the nature of the European downstream oil sector, via the academic frameworks discussed previously. This reason is that there are links which can be identified between the constructs of the theory and the drivers for investment or divestment decisions of firms involved in the European downstream oil sector. These firms are facing the dynamics described in Chapter 2 and they are reacting in different ways when it comes to investments in the downstream oil business in Europe. What is common for all of these companies is that they have to consider whether to invest or not in assets which are highly site and physical specific, and they have to adjust their investment decisions so as to mitigate any temporal specificity issues. Moreover, investment or divestment decisions have to be made in an environment characterized by increased uncertainty and often, small-numbers situations and information asymmetries. In that sense, firms involved in the European downstream oil sector have to consider the potential risks of opportunistic behavior from their exchange partners and how to mitigate these risks. Furthermore, due to the political uncertainty present in some European countries and to the nature of the downstream oil business (sunk investments, economies of scale and scope, mass consumption of oil products), these firms may also be subject to risks of governmental opportunism in these locations. In other European countries where the regulatory regime does not allow for governmental opportunism, firms may be facing risks of third-party opportunism as it was discussed. Therefore, the companies involved in the downstream oil business in Europe have also to decide how to allocate their investment capital, in order to position themselves in markets where the risk of governmental and third-party opportunism is lower. The risk level in a specific market can be indicated by the local regulatory framework and from the political uncertainty present there.

It is therefore possible to relate the drivers for investments or divestments in the European downstream oil sector, which can be found in the literature, to the key constructs of the theoretical framework presented above. This is important because the second research sub-question of this thesis is concerned with the identification of these drivers and as it will be discussed in the next Chapter, the literature review resulted in an extensive initial list of drivers which had to be refined and reduced to a manageable number. One of the tools employed for this reduction process was actually to connect the drivers to the theoretical constructs, cluster them, check for replications/redundancies and eliminate what was unnecessary from the initial list. With this procedure, which is further elaborated in Chapter

4, the author of the thesis managed to transform, in a scientific manner, the initial list of drivers to the final one to be used for the Q methodology research, by using the theory constructs. Therefore, it is believed that the attempt to try to explain the nature of the European downstream oil sector (and of the investments related to it) with the use of TCE and TCR theories, was a necessary, prerequisite step to allow for proceeding with the Q methodology research and for answering the other research sub-questions of this research.

## 4. Q methodology research design

The previous Chapter discussed about how the theory can help describing the characteristics of the European downstream oil sector and the arguments presented helped to answer the first research sub-question. What follows here is a detailed analysis of the steps taken by the author of this thesis, for performing the necessary primary research with the use of the Q methodology technique. This primary research helped to identify first from the literature and then from the data from the Q methodology interview sessions with the participants, the most important drivers behind corporate decisions for investments or divestments in the European downstream oil sector.

The basic steps of a Q methodology research have been mentioned briefly in Chapter 1. These six steps are illustrated in the following figure.

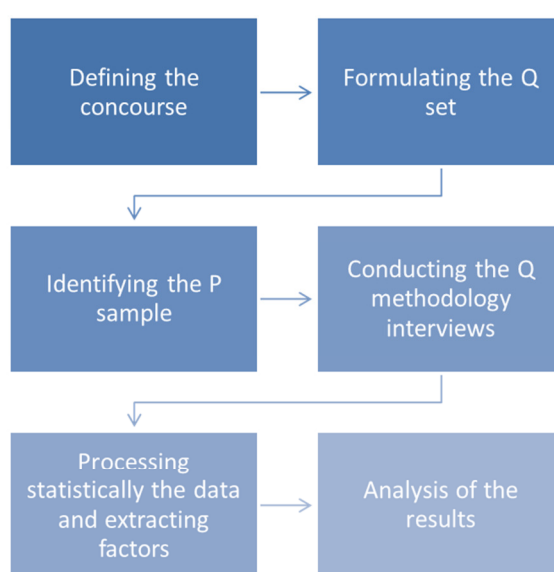


**Figure 14: The six basic steps of Q methodology research.**

The detailed description of the actions taken by the author of this thesis, with respect to the first five of these steps, will follow in the next paragraphs. Concerning the analysis of the results, more information will follow in the subsequent Chapter 5.

### 4.1 Defining the concourse and formulating the Q set

The two first steps for conducting a Q methodology research are to define the concourse about the subject to be investigated and then define the Q set which contains the statements (or otherwise called, items) the participants will have to sort. In essence, the concourse is the overall population of items from which the Q set of items will be formed. As Watts and Stenner (2012, p. 34) put it “concourse is to Q set what population is to person sample (or P set)”. The concourse is the full range of discussions and discourses about a particular topic and defining the concourse means identifying all types of sources which contain ideas, opinions, values, preferences and knowledge statements about the topic (Cuppen, Breukers, Hisschemöller, & Bergsma, 2010). A concourse is difficult to be defined until it has been

circumscribed by a particular research question (Watts & Stenner, 2012). In the case of this research, the main research question which the author of the thesis wants to answer is: *“Which are the most important drivers behind corporate decisions for investments or divestments in the European downstream oil sector?”* This question helps define the concourse, which consists of all opinions, statements and ideas related to the reasons firms decide to invest or divest in the European downstream oil sector. In essence, all the different drivers for investments or divestments decisions that can be identified either from a literature review or from interviews with the respondents before the Q set is formed (Dryzek & Berejikian, 1993) are forming the concourse.

The choice was made to identify these drivers by an extensive literature review and the approach which was followed for defining the concourse (with all the items related to investment/divestment drivers) and subsequently extract from it the Q set, is illustrated in the following figure.

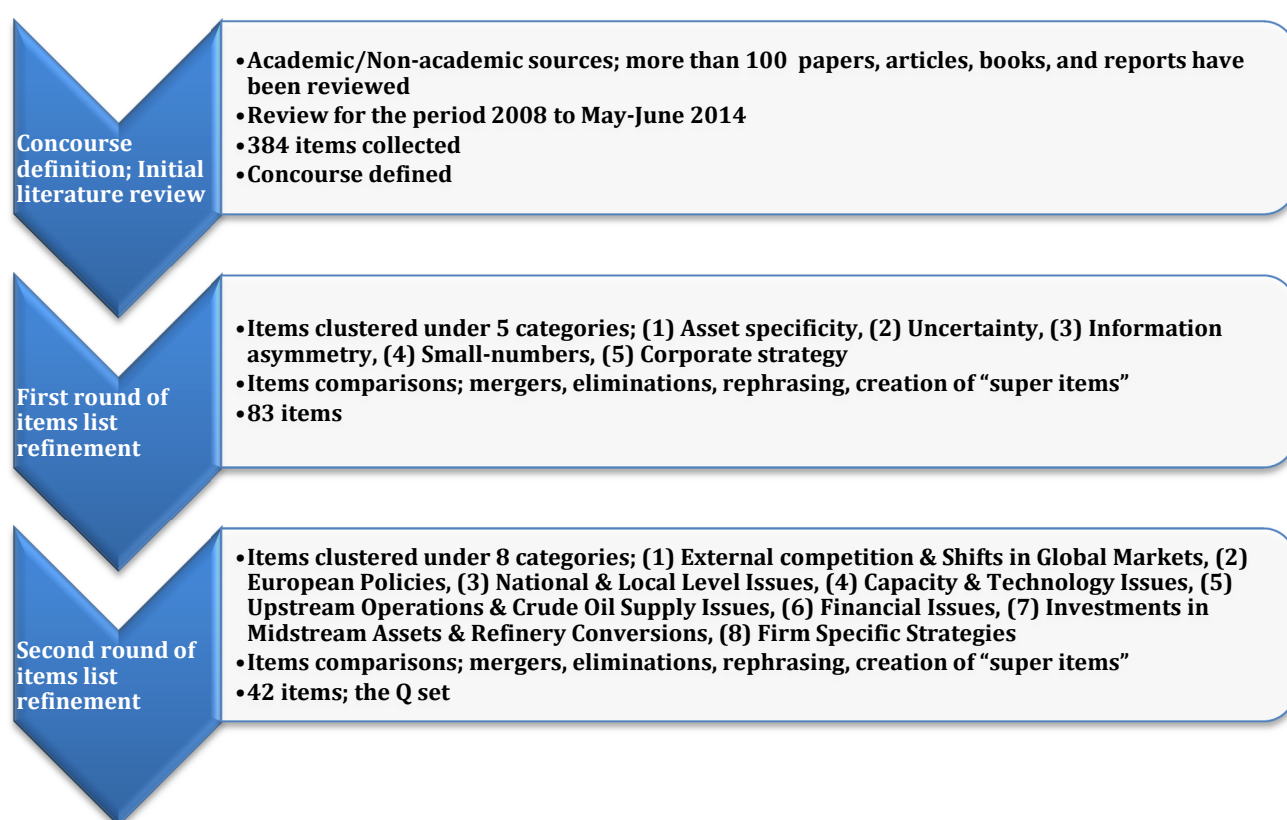


**Figure 15: Procedure for the formulation of the Q set.**

As it can be noticed, this procedure includes three distinct steps which are all discussed subsequently. It should be stressed that there is no such thing as a single or correct way to generate a Q set, and as Watts and Stenner (2012, p. 57) are emphasizing “a Q set must be tailored to the requirements of the investigation and to the demands of the research question it is seeking to answer”. Therefore, the author of this thesis had to decide upon an appropriate procedure for creating the Q set.

#### 4.1.1 Step 1: Initial literature review

At first, it was decided to search in the literature for items which could be related to drivers leading to investments or divestments in the European downstream oil sector.

The literature review for items included academic but also non-academic sources, such as reports from well-acknowledged organizations, reports from top consultancy firms, reports from business press, reports from online media and other popular sources focusing on the oil industry etcetera. Using non-academic sources is something legitimate and as a matter of fact, it is one of the typical methods applied for the Q set items generation (Davies & Hodge, 2007); (Cuppen, Breukers, Hisschemöller, & Bergsma, 2010); (Barry & Proops, 1999). Furthermore, conducting an extensive literature review in both academic and popular texts is considered an effective way to discover the different perspectives in relation to a particular topic. Sound knowledge of the appropriate literature can provide the initial directions for the identification of the key themes or issues that characterize a particular topic (Watts & Stenner, 2012).

Moreover, the literature review was concerned with the identification of items related to every different type of investment or divestment described in the sources. Typical examples were items which were referring to investments in acquiring, expanding or upgrading refineries to change their configuration, investments in petrochemical facilities, investments in refineries for environmental compliance purposes, acquisitions of storage facilities, conversion of refineries to storage, sales of refineries and shutdowns etc. The focus was on identifying, apart from drivers for investments, also barriers for investments or drivers for divestments, and the final goal was to achieve the greatest possible variety of items in order to cover, as much as possible, the topic under consideration. So, for example, identifying the five main drivers for investments, according to how often they have been mentioned in the literature, was not sufficient, and an effort was made to identify as many unique drivers (maybe referring to only one transaction that took place) as possible. Items referring to investments/divestments in retail and marketing networks were not part of the research, as well as items related to investments/divestments in facilities outside of Europe. The use of the word Europe implies that for the purposes of this research, all countries which geographically belong to Europe were taken into account, and the focus was on investments or divestments in those countries.

From what was discussed in Chapter 2 and in the previous paragraph, it should be obvious that there exists a wide variety of different issues that can be related to drivers for different types of investments or divestments in the European downstream oil sector. This reality meant that the author of the thesis had to make some important decisions to ensure that he would create a balanced Q set with adequate representation of this variety (Watts & Stenner, 2012). Indeed, attention had to be paid during the literature review, to carefully consider items related to the full diversity of potential drivers leading to different types of investments/divestments in the European downstream oil sector. Having this in mind, then could eventually lead to a Q set which is broadly representative of the concourse (Watts & Stenner, 2012). The same attention had to be paid with respect to the balance of the Q set. A well-balanced Q set is not value-laden or biased towards some particular point of view (Watts & Stenner, 2012) and it does not make the participant feel “restricted” or frustrated by over- or under-presenting a particular viewpoint. Therefore, the items of the Q set should express all viewpoints found in the concourse and in a relatively proportionate way. Since the majority of the items identified in the literature review about investments/divestments in the European downstream oil sector, were concerned especially with the refining industry and to a lesser extent to the storage and trading business, then a well-balanced Q set should include more items related to the former than to the latter. This practically meant that the author of the thesis had to opt for an unstructured Q set design, where it is allowed to include unequal

numbers of items stemming from the key themes the Q set must cover, whereas in the case of a structured Q set, the same amount of items should be drawn from every different key theme (Watts & Stenner, 2012).

Having all the previous considerations in mind, the author of the thesis initiated the literature review. The sources which were used and investigated were all freely available to the author of the thesis, by the library of Delft University of Technology. Some indicative sources were reports and articles from the International Energy Agency, Bloomberg, Oil and Energy Trends, Oil and Gas Financial Journal, OPEC review, Oxford Institute for Energy Studies, Reuters, IFP Energies Nouvelles, but also reports from firms such as Ernst & Young, KPMG, McKinsey, Accenture, AT Kearney, Purvin & Gertz, Wood Mackenzie etc. Last but not least, the sources included also other academic papers and books dedicated to the oil industry. A detailed list with all the bibliographic information about the sources used for this specific literature review can be found in Appendix B of this report.

It should be stressed that wherever it was applicable (sources with databases), the literature review was performed for the period from 2008 till (May-June) 2014. Additionally, the key words which were used to identify articles and reports relevant to the research topic, included the following: European downstream (oil/petroleum) sector, European refineries, European refining sector, (downstream) investments in Europe, investments (European) refineries (or refining sector) etc.

This initial but also extensive literature review led to the collection of 384 items, which are all explicitly or implicitly highlighting a driver leading to specific types of investments or divestments in the European downstream oil sector. The full list of these items can be found in Appendix B of this report. Obviously, there were many replications and redundancies among these items, but the author of the thesis followed the approach proposed by Watts and Stenner (2012), who advocate researchers using Q methodology to always aim to create an overly large number of items which can then be refined and reduced. The authors also add that this approach is preferable than starting the item collection procedure with an appetite which is overly restrictive or dismissive of possible content. Nevertheless, 384 items is a very large number for both practical and theoretical reasons. As a matter of fact, a standard Q set usually has 40 to 80 items (Watts & Stenner, 2012), even though valid results can be obtained with only 36 items (Barry & Proops, 1999), so it was obvious that the next step for the author of this thesis was to try to reduce the items to a manageable number.

#### **4.1.2 Step 2: First round of items list refinement**

In this first round of refining the list of items and reducing their number, there was a primary need to cluster these items so as to facilitate the identification of redundancies and replications, but also to uncover opportunities for mergers or deletions. It was at this point where the usefulness of the theoretical analysis in Chapter 3 about how TCE and TCR can be used to describe the European downstream oil sector, was revealed. As it was introduced in paragraph 3.8, it was possible to connect all the drivers identified in the initial items list, with the main constructs of the theoretical framework. These constructs were actually used to successfully create the categories under which the items could be clustered. Indeed, the items were selected and placed under five categories which were namely; (1) Asset Specificity, (2) Uncertainty, (3) Information Asymmetry, (4) Small Numbers and (5) Corporate Strategy. All items from the initial list were related to one or more of these categories. So for example, items mentioning that small, unsophisticated and inland refineries in Europe are suffering the most and are likely to close in the future (Oil and Energy Trends, 2014); (Oil and Energy Trends, 2013), are

directly connected to the site and physical asset specificity dimensions of asset specificity, so they fall under category 1. Similarly, all items could be positioned under one or more categories. Obviously, the last category (Corporate Strategy) is not a specific construct of TCE but the author of the thesis decided to create it in order to group all items which (i) could not fit in any of the other categories, which (ii) were related to corporate decisions for vertical (dis)integration downstream in Europe (governance form choices), and for the ones (iii) concerned with generic corporate strategy. It is important to mention that the theoretical constructs used for this categorization are related directly or indirectly to TCE, as TCR does not provide with similar tools. However, the political uncertainty dimension of the uncertainty construct is believed to be adequate enough to “cover” the drivers related to risk of governmental or third-party opportunism.

Associating the initial items with one of the five categories was only the first step of the systematic approach employed for reducing their number. This approach is illustrated in the following figure.

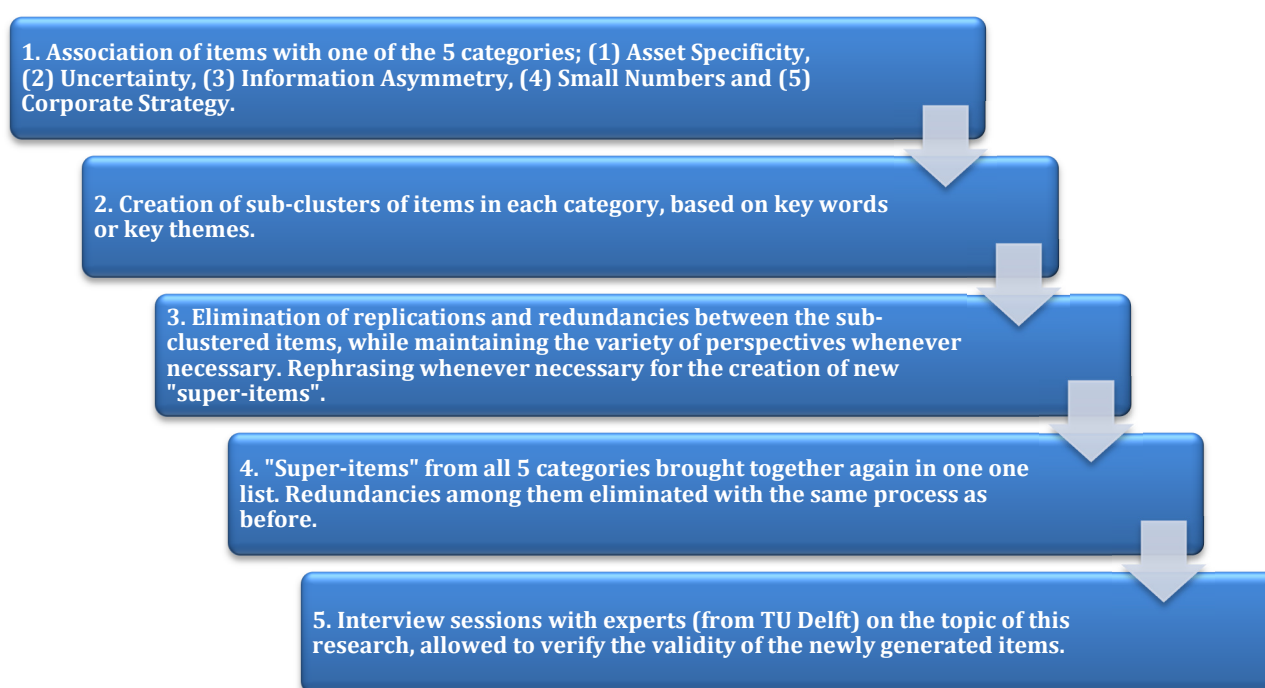


**Figure 16: A systematic approach for reducing the initial list of 384 items in the first refinement round.**

The next step was to sub-cluster the items in each individual category and ultimately eliminate repetitive items or merge them in order to reduce their number. To give an example about this, there was first a need to create these sub-clusters of items in the list related to asset specificity. Initially, a screening of all the items in this list took place where key words or key themes were identified, such as “gasoline surplus or gasoline-heavy configuration”, “middle distillates”, “environmental legislation or regulation”, “pressure by governments/labor unions”, “surplus of refining capacity”, “bio-fuels” and so on. These key words or phrases helped to identify and group together items of the asset specificity list, referring to the same topic and having the same or a different perspective (considering something as a driver or barrier for investments or divestments). This item-grouping enabled the author of the thesis to easily identify replications and redundancies between the items and eliminate those by following two strategies; the first was employed in the case where items were very similar by referring to the same

issue from the same point of view. In these cases only one of these items was retained (the most representative) and the rest of them were discarded. The second strategy was to generalize an item in order to include the different considerations expressed by a second or more items touching upon the same issue, again from a similar point of view (e.g. perceiving a factor as a driver for investments but with a different reasoning about it). To provide a typical example about this strategy, there were again the initial items mentioning that small, inefficient and unsophisticated refineries are the most vulnerable in Europe (Oil and Energy Trends, 2013), and other ones mentioning that small and landlocked refineries are in the verge of closure (Oil and Energy Trends, 2014). These (and other arguments from items referring to the same topic) were eventually combined to create a new item mentioning that small, old, unsophisticated, gasoline-making refineries which are located in inland markets with few export opportunities, cannot compete effectively in Europe and should be divested.

Nevertheless, the diversity of different perspectives among items was retained. To give an example about this, in a hypothetical scenario were three initial items would be considering the middle distillates deficit in the European market as a driver for investments in refineries (in hydrocracking units) and one item would be considering this as a driver for exiting the business, the effort would be to reduce the three former items to one or two and keep the latter one as it is. In this way, the initial four items could be reduced to two or three. This procedure was followed for every items sub-cluster in all five categories.

Of course, rephrasing of items was necessary during this procedure, with the use of either more generic wording (to broaden their semantic content) or by combining words from the initial items into a new “super-item”. Moreover, in order to help revealing the importance of items in the views of participants, some emphasis was given by using words such as “a major driver” or “a main driver”. It is believed that these words could help participants to better discriminate the items. Once this process was completed, then the new “super-items” from all five lists (categories) were again placed all together, in the same list. This allowed for cross-checking for redundancies among the “super-items” originating from different lists and enabled the author of this thesis to further reduce their number, again by following a similar approach as the one discussed in the previous paragraphs. In the end, the initial list of 384 items was reduced to a list of 83 items. Both the lists can be, respectively, found in Appendix B and C of this report.

Concerning the wording of the new items, there was an effort to maintain as much as possible from the initial wording. However, in many cases significant changes had to be made, as the items were company and/or country specific, so they had to become more general in order to allow the participants to “identify” themselves with them as much as possible, during the interviews. Furthermore, there were two other issues related to the phraseology of the items which were considered by the author. The first has to do with avoiding the use of negative expressions in the items. As Watts and Stenner (2012) mention, the use of items with negative expressions constitutes a potential problem because in cases of disagreement of participants with them, a double negative situation emerges. In these cases there is ambiguity and the correct interpretation of a participants’ opinion is difficult. Therefore, the author of this thesis rephrased items wherever necessary, to avoid this confusion. The second issue which was taken into consideration is that in Q methodology, the items of the Q set should be thought as suggestions and not as statements with determinate meaning (Brown, 1980); (Watts & Stenner, 2012). Hence, the items should be more normative and allow the participants to “impose their own meanings” onto them via the sorting process and also to “infuse them with personal, or psychological, significance” (Watts & Stenner, 2012, p. 64). This was one more reason the author of this thesis intervened to the phrasing of the items, only when this was a necessity.

At the end of this first items-list-refinement round, the author of this thesis presented these 83 items in front of experts on the topic of this research, from the Faculty of Technology, Policy and Management of Delft University of Technology. These interview sessions allowed the researcher to verify the validity of the generated items, implement corrections whenever necessary, and eventually enabled him to continue with the second round of items list refinement.

#### 4.1.3 Step 3: Second round of items list refinement

Reducing the 384 items to 83 was a good first step for the creation of the final Q set. Nevertheless, 83 are still too many, so there was a need for further reducing their number. The author of this thesis decided to adopt a similar approach as the one of the first round of items list refinement, where items had been clustered under some categories, in order to further facilitate comparisons of items leading to mergers and/or erasures in cases of redundancies. In this case though, different categories were used to group the items. Since the items were “describing” different potential drivers for investment/divestments in the European downstream oil sector, they were all related to specific domains such as, for example, the European environmental legislation or the competition the sector is facing from other global regions. These domains were then “translated” to the categories used for grouping the items in this second round of items list refinement. Hence, the following eight categories were used; (1) External competition & Shifts in Global Markets, (2) European Policies, (3) National & Local Level Issues, (4) Capacity & Technology Issues, (5) Upstream Operations & Crude Oil Supply Issues, (6) Financial Issues, (7) Investments in Midstream Assets & Refinery Conversions, (8) Firm Specific Strategies. The items were clustered under these categories and then a new process of mergers and eliminations began. Again, rephrasing was necessary and the same rules which had been applied in the first items refinement round were followed in this second round. All the considerations about the wording of the items explained in the previous paragraph were also taken into account and at the end of this process, verification of the validity of the newly-generated items was obtained again through interviews with the same experts from TU Delft. In essence, all five steps referred in Figure 16 took place in this second round of items list refinement, with the sole difference being the main categories used. In the end, a list of 42 items was generated which actually consisted the Q set of this study. The Q set items are presented below.

- |                                                                                                                                                                                                        |                                                                                                                                                                                                                                  |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>1. <i>The growing competition European refiners face from their Russian counterparts in the European market, works mostly as an incentive for upgrading investments in European refineries.</i></p> | <p>6. <i>Changes in supply and demand patterns in Europe is a major reason for acquisitions of storage facilities or conversion of refining facilities to storage in the region, to help handle the new commodity flows.</i></p> |
| <p>2. <i>The fall of demand for gasoline in the US market is a significant driver for divestments in the European downstream oil sector.</i></p>                                                       | <p>7. <i>The need to comply with the European environmental legislation (including biofuels mandates), works mostly as an incentive for upgrading investments in refineries.</i></p>                                             |
| <p>3. <i>A major driver for acquiring downstream assets in Europe is because is a good way to help to serve the growing demand for fuels in Asian countries.</i></p>                                   | <p>8. <i>Acquisitions of less profitable downstream assets in Europe, are justified for reasons of extended (foreign) policy reach through energy market control.</i></p>                                                        |
| <p>4. <i>Effective tax rates in Europe is an important driver for divestments in the European downstream oil sector.</i></p>                                                                           | <p>9. <i>Retaining sufficient refining capacity in Europe is a key factor for the region's energy security.</i></p>                                                                                                              |
| <p>5. <i>The high taxes on emissions in Europe is a major driver for divestments of refining assets.</i></p>                                                                                           | <p>10. <i>The Compulsory Stock Obligation (CSO) represents a cost for the industry, as it does not allow it to run down its stocks</i></p>                                                                                       |

to the lowest level consistent with its operational requirements.

11. The substantial surplus of refining capacity in Europe can only lead to divestments of refining assets.

12. Political pressure by European governments and labor unions on companies, is an important barrier for divestments of their uneconomic or poorly performing assets in Europe.

13. The growing competition European refiners face from their US counterparts worldwide, works mostly as an incentive for upgrading and expansion investments in European refineries.

14. A major reason for exiting the refining business in Europe is the strong labor laws and high wages.

15. Most European refineries are configured to produce gasoline, however the European market demands more middle distillates, which is a major driver for upgrading investments in refineries.

16. A major reason for acquiring storage facilities or converting refineries to storage in Europe, is compliance with compulsory stock obligations.

17. Acquisitions of refineries in Europe, is a good way to secure downstream outlets for your crude oil production and have a more efficient planning of output over time.

18. European refiners should invest more in chemical operations, as they will be able to offer a broader slate of products which can cushion against market-demand swings for fuel products.

19. The current oversupply in the market will end, as smaller refineries close, therefore acquisitions of refineries in Europe can be justified.

20. The higher volatility and lower returns from investments downstream, than the ones from investments upstream (crude oil production), are a major driver for divestments of downstream assets in Europe.

21. Acquisition of midstream fixed logistic assets leads to better and faster exploitation of arbitrage opportunities.

22. A major reason for acquiring refineries and/or storage facilities in Europe, is the region's strategic location which offers global connectivity and increased trading potential.

23. The declining North Sea production and Urals availability, combined with increased future availability of other crude blends, is a good reason to invest in changing the European refineries configuration.

24. Local opposition is a major barrier for expanding or upgrading refining facilities in Europe.

25. European refineries cannot compete with the new refineries in Asia and Middle East, as the latter are of high complexity and scale, and this works mostly as a driver for upgrading and expansion investments in European refineries.

26. Weak corporate balance sheets and the difficulty to access credit is a major barrier for investments in the European refining sector.

27. A major driver for acquiring refineries in Europe is that you can gain a foothold in the region, without having to invest huge capital as many refineries are for sale at favorable prices.

28. A major reason for divesting downstream assets is to boost the stock price and/or increase dividend payments to shareholders.

29. A major reason for acquiring European refineries and converting them to storage facilities for trading purposes, is that an established site simplifies compliance for environmental regulations.

30. Investments in the European refining sector are important for job creation purposes.

31. A major reason for converting unprofitable European refineries to terminals is mitigation of potential closure costs (including environmental, demolition, employee compensation and legal costs).

32. A major reason for converting unprofitable European refineries to terminals is reduction of the plants' costs and release of working capital.

33. The ownership of midstream physical assets in Europe and the creation of end-to-end supply chains open opportunities to gain access to exclusive and unpublished market information.

34. The increasing activity from independent retailers/distributors and hypermarkets, is a major reason for acquiring storage facilities or converting refining facilities to storage in Europe.

35. The mature European downstream market makes attractive the option to divest downstream assets in Europe and refocus on a strong downstream presence in other growth markets.

36. An important reason for investing in the European downstream sector is risk and overheads spreading, as well as hedging against currency fluctuations.

37. The JVs of oil companies in the refining sector of non-European countries, help them shut refinery capacity in Europe and supply their wholesale and retail European networks with products from these countries.

38. Asset light strategies are preferred in Western Europe, due to the region's liquidity in petroleum products, good infrastructure, low refining margins and inadequate raw materials base.

39. The emergence of numerous traders, who have facilitated a liquid and competitive market for crude oil and refined products, makes downstream vertical disintegration attractive for oil companies.

40. The higher freight costs for moving refined products to Europe from outside the region, than the costs for moving

crude oil, is a major reason for investments in refineries located in Europe.

41. Asset-heavy strategies are becoming attractive because of the rise of financing and transaction costs due to regulatory changes in the banking and derivatives-trading environment.

42. A major reason for acquiring assets in the European downstream oil sector is for accessing new skills and capabilities in specific businesses within the oil value chain, for example oil products marketing.

These 42 items were eventually presented in front of the participants, who were asked to sort them and create their own Q sort out of the Q set. However, before being able to start conducting Q sorting interviews, the items had to be printed on small cards which the participants would be asked to position under a relative scale expressing degree of agreement with the items. Indeed, 42 small cards were prepared with each one of them illustrating one of the 42 items. Each card was given an identification number (the same with the item numbers above) and it was ensured that cards with items touching upon the same topic (for instance environmental legislation) are not numbered consecutively (Watts & Stenner, 2012).

### *Answering the second research sub-question*

The creation of the Q set and the 42 items, consists actually the response to the second research sub-question of this thesis research:

*“Which are the most important drivers behind investment or divestment decisions of companies involved in the European downstream oil sector that can be identified in the literature?”*

At this point, the two first sub-questions of the main research question have been answered and the focus shifts on finding the answer for the third and final sub-question, with the conduction of the actual Q methodology sessions.

Following the Q set creation, the next step was to identify the appropriate respondents to participate in the research. This will be the topic of discussion in the following paragraphs.

## **4.2 Identifying the P sample**

Finding the right people to participate in the research was the next important step. This group of participants, which is named the P sample in Q methodology, consists of the people who were asked to evaluate the items (so also the investment/divestment drivers) of the Q set under a relative scale. However, finding the right sample size and mix of people, is not so straightforward in Q methodology research.

Concerning the composition of the P sample, researchers have advocated against opportunity sampling (Watts & Stenner, 2012) or random sampling (Cuppen, Breukers, Hisschemöller, & Bergsma, 2010) methods. Opportunity sampling may have some negative repercussions for the research, because in Q methodology, the participants are actually the variables and the Q set is the study sample. This means

that it is crucial to carefully consider who should be part of the P sample, although it is acknowledged that opportunity sampling may often be a practical necessity (Watts & Stenner, 2012). Random sampling may also be problematic because it assumes implicitly that all members of the population have equal knowledge about and expertise on the topic. Thus, this way of sampling disregards the fact that particular knowledge about the topic can be found among particular people who are related in one way or another to specific groups or institutions (Cuppen, Breukers, Hisschemöller, & Bergsma, 2010). In principle, what is proposed as a more appropriate way of defining a P sample is purposive sampling (Cuppen, Breukers, Hisschemöller, & Bergsma, 2010). This is the case because Q methodology aims to give a holistic picture about a particular topic and identify the different perspectives towards it, and hence it is meaningful to include in the P sample every participant which is believed to have a different, interesting or pivotal point of view (Watts & Stenner, 2012); (Cuppen, Breukers, Hisschemöller, & Bergsma, 2010). Diversity counts in Q methodology and even if there is only one person with a different perspective, he or she should be included in the P sample.

The previous facts made the author of this thesis to consider the diversity of perspectives towards the dynamics in the European downstream oil sector and consequently, towards the drivers included in the Q set. First of all, it was clear that not every individual is a good potential participant. Obviously, employees of firms involved in the European downstream oil sector, individuals from governmental agencies related to the oil sector and also researchers from institutions which are focusing on energy matters, are expected to be significantly more knowledgeable about the topic of this research and thus, they had to be included in the P sample. Moreover, it was important to include employees from firms involved in different businesses within the sector, as well as firms of a different size. Indeed, this was the case as in the end the P sample included individuals related to the following companies and organizations:

**Table 1: P sample participants.**

| Participant No. | Company/Organization                                                                                              |
|-----------------|-------------------------------------------------------------------------------------------------------------------|
| 1               | Vesta Terminals                                                                                                   |
| 2               | Clingendael; Netherlands Institute of International Relations / Clingendael International Energy Programme        |
| 3               | Kuwait Petroleum International (Q8)                                                                               |
| 4               | Ministry of Economic Affairs of the Kingdom of the Netherlands; DG for Energy, Telecommunications and Competition |
| 5               | Royal Dutch Shell                                                                                                 |
| 6               | COVA / Netherlands National Petroleum Stockpiling Agency                                                          |
| 7               | ExxonMobil                                                                                                        |
| 8               | European Commission; DG Energy                                                                                    |
| 9               | FuelsEurope                                                                                                       |

|    |                                                                              |
|----|------------------------------------------------------------------------------|
| 10 | British Petroleum (BP)                                                       |
| 11 | Consultancy Firm providing services to the downstream oil business           |
| 12 | Hestya Energy                                                                |
| 13 | Delft University of Technology; Faculty of Technology, Policy and Management |

As it can be seen from the previous table, all of the participants are from firms and organizations, which in one way or another are related to the European downstream oil sector. This ensures that they have sufficient knowledge about the research topic. The participants' roles are not specified, as full specification of their role would endanger their anonymity which the author of the thesis was requested to provide.

Despite the effort to have a fully strategic approach to recruiting participants, it was inevitable sometimes to avoid opportunistic sampling due to time constraints. Indeed, there were a few cases where snowball sampling was employed and participants provided contact information of some of their acquaintances for further participant recruitment. Nevertheless, the necessity for snowball sampling is not considered to have had a significant negative impact on the quality of the research. The reason is that the participants who were recruited in this way were also individuals with knowledge relevant to the topic and as a matter of fact, they were also expected to express a different perspective with respect to the topic of the research as all of them were related to different organizations.

To summarize for the mix of the P sample, it is believed by the author of this thesis that there is an adequate representation of different perspectives of individuals with different roles and from different organizations, in order to have an adequately-balanced sample considering time and resources constraints. Consequently, the author of this thesis believes that the quality of the research is ensured with respect to having an appropriate sample of participants. Some bias of course may exist, as the P sample is not perfectly-balanced and there is a limited representation of specific viewpoints, such as the one of individuals from NOCs or independent refiners. A more elaborate discussion about this issue follows in Chapter 6, as this is one of the limitations of this research.

A final important comment at this point is that most of the participants made clear that they are expressing their own point of view and not the point of view of the organization they belong in. This is of course understandable and also acceptable, since having the official point of view of the organizations would require a different setting for the interviews. This was not required for this research, as the matter of importance was to recruit individuals with knowledge about the respective thesis topic and to make sure that there is (expected) diversity among their perspectives. Indeed, all the people who were eventually involved come from a different background and are considered to be experts in the European downstream oil sector. Hence, the validity of their answers with respect to the thesis topic is believed to be ensured.

The author of this report would also like to state that although names of specific firms and organizations are mentioned throughout this analysis and particularly during the discussion in Chapter 5, this does not imply that the opinions expressed are in any case the official views of these companies

and organizations. The opinions expressed are personal opinions of the participants in the interviews and this thesis report does not claim otherwise.

#### 4.2.1 Sample size

The second important issue concerning the P sample is the number of participants. There is no specific rule in the literature for identifying the size of the sample. In principle, Q methodology does not require a large number of participants to produce valid results, as it is based on the assumption of “finite diversity” which means that there are not generally as many discourses about the topic under consideration, as there are participants (Barry & Proops, 1999); (Ellis, Barry, & Robinson, 2007); (Watts & Stenner, 2012). As a matter of fact, Barry and Proops (1999) identify that even as few as 12 participants may be enough to generate statistically meaningful results from a Q set of 36 items, because each participants Q sort provides a very large amount of information. The approach “the more participants, the better” is not exactly applicable in the case of a Q methodology research, as this research technique does not primarily aim to generalize the findings to a wider population of people. Instead, it tries to reveal the diversity of perspectives about the issue at stake and to understand, explicate and compare these perspectives (Brown, 1980); (Watts & Stenner, 2012). The number of participants has often been connected to the number of items in the Q set, however there is no consistency in the literature about how the latter number should determine the former one. A simple, basic rule proposed by Watts and Stenner (2012), is that the number of participants should not exceed the number of items in the Q set.

Following from the previous discussion, a good sample size for this thesis research would be something higher than 12 and lower than 42 -the number of items in the Q set. Moreover, the author of this thesis sought advice about this topic, from members of the academic staff of the Faculty of Technology, Policy and Management of Delft University of Technology, who are experienced in the use of Q methodology technique for their research. The main guideline was that a number of 15 participants would be sufficient and this became the target number of the author of this thesis. Nevertheless, it turned out to be impossible to reach this number of participants within the limited time-frame of this thesis research and in the end 13 individuals were interviewed. Since the sample size is greater than 12 and is quite close to the target of 15 participants, it is still possible to extract valid results from the Q methodology sessions.

#### 4.3 Conducting the interviews

The interviews with the participants took place between June and August 2014, in various locations in the Netherlands and in Brussels, Belgium. The interviews typically lasted 60 to 90 minutes and they were divided into three parts, with the emphasis being on the task of sorting the items of the Q set. Next to this, the participants were also asked some questions which are believed to help the author of this thesis to better understand the participants’ points of view, and additionally provide more qualitative information to aid for a better analysis. The three parts of every interview session are namely the pre-sorting introduction and information part, the Q sorting procedure part and finally, the post-sorting information part. These are all elaborated in the following paragraphs.

#### 4.3.1 Pre-sorting introduction and information

This is the first part of every interview session. At first, all the participants were informed that their anonymity is guaranteed, which is something the author of the thesis ought to respect. Moreover, once the consensus of participants for recording the interview with digital means was ensured, the formal interview procedure could start. It should be mentioned that the topic of the research and the procedures of the interview sessions had been explained to the participants prior to these sessions, via explanatory emails. Nevertheless, at the beginning of each one of the interview sessions, the author was introducing again the topic to the interviewee and was elaborating on the research objective and questions to be answered.

The next step was to explain to the participants how Q methodology works and in which way he or she should sort the items of the Q set, in order to create a unique Q sort. The whole procedure was explained, but there were specifically two issues which were emphasized; the first was the relativity of the scale under which the participants had to place the cards with the items, as the scale did not include any absolute values. As the participants were asked to place the cards in columns under a scale ranging from -5 to +5 (representing most disagreement and most agreement respectively), it was stressed that placing a card under -1 for instance, does not necessarily imply disagreement with the items on the card, as it may be that the participant agrees less with this item compared to one other which is placed under 0 or agrees more compared to the items under -2. The second was that the order of cards under the same column of the scale does not play any role (so for example the 1<sup>st</sup> and 2<sup>nd</sup> card under column +5, are both ranked +5 and their sequence does not make any difference).

Subsequently, the participants were asked to state their name, the name of the organization they belong in and finally, their role within this organization. Wherever it was applicable, there were two more extra questions; one about which activities are performed by the organizations participants are related to, and a second about what kind of investments or divestments (or both) the organization (in cases of firms) carries out in the European downstream oil sector. These kinds of questions were asked because they were expected to facilitate the analysis of the author of this thesis and provide more qualitative information to help with the interpretation of the results. Watts and Stenner (2012) have strongly advocated in favor of these types of pre-sorting questions as a means to facilitate post-sorting analysis.

Last but not least, before starting with the card sorting there were two clarifications made to the participants, both related to the wording used in some of the items. Firstly, to avoid misunderstandings, interviewees were informed that the use of the word “downstream” in the items implies that the focus is only on refining and storage (or terminal) facilities, but not on assets related to retail or marketing operations. Whenever this was not the case, then the use of words such as “refineries”, “refining sector”, “storage facilities” or “midstream assets” (referring to storage and terminals), was making explicit which should be the consideration of the interviewee. The second issue to be clarified had to do with item No. 4: “Effective tax rates in Europe, is an important driver for divestments in the European downstream oil sector”. During the first interview, the participant noticed that the meaning of the word “effective” is a bit confusing. It was made clear to the participant that “effective tax rate” in this case means the real tax rate, as it is often called in financial terminology, and it does not mean an effective tax rate in terms of effectiveness. This remark was taken into consideration in all subsequent interviews and participants were informed about this distinction prior to the Q set sorting procedure.

### 4.3.2 Q sorting procedure

This is the part of the interview where the participants were asked to create their own Q sort from the Q set. In other words, they were asked to place the 42 cards with the items under the relative scale ranging from -5 to +5, in different places depending on how much they agree or disagree with them. Of course, it was again clarified to participants that they had to express their agreement or disagreement about which of the items “represent” the most important drivers for corporate investments or divestments in the European downstream oil sector. The scale used included the numbers -5, -4, -3, -2, -1, 0, +1, +2, +3, +4, +5, which were also printed on cards and were presented in front of the participant. Then the interviewees were instructed to place the cards according to a forced normal distribution with 42 slots from most agree to most disagree.

The shape of the distribution was not chosen randomly. In principle, opting for a forced normal distribution or a free distribution is not supposed to make any difference, as researchers have proved and emphasized that the shape of the distribution is not affecting the factors which will emerge during the analysis and distribution effects are practically non-existent (Brown, 1980); (Watts & Stenner, 2012); (Barry & Proops, 1999). Nevertheless, choosing for a forced normal distribution has become a standard when conducting a Q methodology research, mainly due to the practical convenience it offers the researcher when comes the time for the analysis (Frantzi, Carter, & Lovett, 2009); (Watts & Stenner, 2012). Moreover, there is the issue that despite of the freedom a free distribution gives to participants to place the cards as they wish, in the end it makes decision making for them more difficult, as they have many more options to choose from when placing the cards. It is therefore preferred to have a fixed normal distribution, not only for the convenience of the researcher but also for the convenience of the participant (Watts & Stenner, 2012). In the end, the benefits of a fixed distribution can be simple highlighted from the fact that this has become almost the standard choice of researchers involved in Q methodology studies (Watts & Stenner, 2012).

Following Watts and Stenner (2012) who advocate that both extremes of the distribution should be represented by a “most”, the participants were asked to define if they “most agree” or “most disagree” with the items on the cards. Two more issues had to be investigated before defining the final outlook of the distribution, namely its range and its slope. For the former issue, the author of this thesis decided to choose an 11-point (-5 to +5) scale, since the Q set of this study contains 42 items and as it was suggested by Brown (1980), 11-point scales are suitable for Q sets with 40 – 60 items. Concerning the latter issue of the slope (or else the kurtosis) of the distribution, the author of the thesis consulted again Brown (1980) who advocates for a steeper distribution when the research topic is very complex or when the respondents are quite unfamiliar with it, so that they can place more items in the middle of the distribution. On the contrary, when the topic is more straightforward or the participants are more knowledgeable about it (if they are experts for example), a more flattened distribution is appropriate because it is less difficult to make agreement discriminations between items. In the case of this thesis, the author decided to adopt a relatively flattened distribution, as all the participants were considered to be very knowledgeable about the topic.

In the end, the distribution which was chosen, along with its scale, is illustrated in the following figure.

| -5  | -4  | -3  | -2  | -1  | 0   | +1  | +2  | +3  | +4  | +5  |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|     |     |     |     |     |     |     |     |     |     |     |
|     |     |     |     |     |     |     |     |     |     |     |
| (2) |     |     |     |     |     |     |     |     |     | (2) |
|     | (3) |     |     |     |     |     |     |     | (3) |     |
|     |     | (4) | (4) |     |     |     | (4) | (4) |     |     |
|     |     |     |     | (5) |     | (5) |     |     |     |     |
|     |     |     |     |     | (6) |     |     |     |     |     |
|     |     |     |     |     |     |     |     |     |     |     |

**Figure 17: The Q sort distribution of this study.**

As it can be seen from the figure, following the distribution of the white slots, the interviewees could place only 2 items under (-5, +5), 3 under (-4, +4), 4 under (-3, -2, +2, +3), 5 under (-1, +1) and finally 6 items under (0).

To return to the sorting of the items by the participants, the last piece of advice given to them by the author of this thesis before starting reading the cards and creating their Q sort, was to perform an initial “screening” of the items and divide them into three different initial categories. Following the advice of Watts and Stenner (2012), in the first category (or pile of cards) the participants were asked to place all the cards with items for which they definitely agreed with or felt positive about, while in the second they were asked to do the same for the ones they really disagreed with. In the remaining third category, they were told to place all the cards with items for which they felt indifferent, had mixed feelings, were unsure about or had difficulty to judge due to lack of knowledge. No limits were imposed in the number of items the participants were allowed to place in every category.

The reason for dividing the cards in these three categories is to facilitate their subsequent sorting by the participant. In this way, the author was advising the interviewees to start only with the pile of cards with the positive items and to try to place them under the positive pole of the scale (+5). After this “initial” sorting was completed, the participants were given the freedom to decide if they wanted to continue by sorting the cards with the neutral items or the negative items. By taking these steps, decision making became easier for the participants and therefore they faced less difficulties to proceed to the complete sorting of all the cards.

After sorting the cards of the complete Q set, the participants were encouraged to cross-check where they have placed the cards and shift them to other positions, if they felt it was necessary. Once the participants were sure that they have finished with the cards placement, the author of this thesis was writing down on a data sheet the positions of the cards by using their ID numbers. A sample of the data sheet which was used can be found in the Appendix D of this report. With the same strategy applied for every interview, the author of this thesis managed to collect all of the individual Q sorts which were eventually used for extracting the results of this research.

### 4.3.3 Post-sorting information

This is the final part of the interview sessions, where the author of this thesis was asking some questions to the participants, in order to extract some qualitative information to help during the analysis. Brown (1980, p. 200) mentions that a post-sorting interview “is an important step often overlooked in Q studies” and in general, such an interview is a means of increasing the richness and the quality of the data collected (Gallagher & Porock, 2010). It is therefore obvious that in order to increase the quality of information from the interview sessions, the Q sorts should be combined with some questions to the participants.

All the questions that were asked were related to the items of the Q set, as the author of the thesis tried to keep the focus of the interviewees on these items. The questions the participants were asked were the following:

- “Can you elaborate on the reasons you placed these statements at the extremes (+5, +4, -4, -5)? Why do you feel so positively or negatively about them?”
- “Are there other specific statements (also towards the middle of the distribution), for which you would like to make a comment about?”
- “Do you think there is any relevant topic that is missing from the statements that were presented to you or any topic which is underrepresented in the statements?”

These three questions are typical post-sorting questions (Cuppen, Breukers, Hisschemöller, & Bergsma, 2010); (Watts & Stenner, 2012), which help the researcher to extract more information from the participant and understand the logic behind some of their choices to place specific cards at specific slots of the distribution. It should be added that the post-sorting interviews often resembled a discussion, where the participants were free to give a comment about all of the items (when time allowed), or they were also asked to give their own general opinion and remarks about the dynamics and the future of the European downstream oil sector.

All the interviews with the participants have been transcribed. Although the transcripts from these interviews are not presented in the Appendices of this report, for report-length considerations, the material is in the disposal of the author of this thesis and can be accessed upon request.

## 4.4 Processing the data and extracting the factors

The next step of the research was to use the datasets from the interviews in order to make a statistical analysis. The purpose of Q methodological research is to identify similarities between the different Q sorts and to allow for the creation of some “typical” Q sorts or otherwise perspectives about the topic of the research (Barry & Proops, 1999). These “typical” Q sorts are representing a common viewpoint broadly shared by a number of participants (Davies & Hodge, 2007). The most commonly available tool to make the statistical analysis is the PQMethod (Schmolck, 2014), which is a freely accessible dedicated Q methodological software package. This software initially correlates the different Q sorts with each other and a correlation matrix is created. This matrix is then factor analyzed either by a Principal Component Analysis (PCA) or a Centroid Factor Analysis (CFA) (Watts & Stenner, 2012); (Frantzi, Carter, & Lovett, 2009).

There are significant differences between these two techniques, as for example, PCA does not generate factors like CFA, but principal components. Moreover, there are conceptual differences related to which

types of variance (common, specific, error) these techniques take into account. These differences are further elaborated in Appendix E of this report. What can be said though is that PCA is more appropriate for researchers who want to “explore” for general patterns in the data, without having a theory about the relationships among variables (Q sorts in this research). On the contrary, Factor Analysis (FA) is better to be used when such a well-grounded theory exists and the researcher wants to discover more about these relationships (Brown J. D., 2009). However, despite of their differences, PCA is often referred as a Factor Extraction technique, since it is a variable reduction technique (Brown J. D., 2009); (Suhr, 2005), and both of these techniques for variables-reduction (finding “typical” Q sorts/factors), usually generate quite similar results in practice (Harman, 1976). Therefore, for reasons of convenience and from now on, the author of the thesis will be referring to extracted factors irrespectively of which method was used for their extraction (PCA which generates components or CFA which generates factors).

To conclude, the factors which are extracted in a Q methodology research are in essence an expression of the similarities between the data and indeed, they will help revealing the key viewpoints that are held in common within the participant group (Watts & Stenner, 2012). In the end, and before the analysis starts, factors are usually rotated either “by-hand” or by using the Varimax procedure. It is not the purpose of this thesis to explain all the “theoretical” statistical considerations behind the procedures of factor creation and interpretation. However, some important steps and decisions which were taken by the author of this thesis for identifying meaningful factors are elaborated in the next paragraph.

#### 4.4.1 Factor extraction based on Principal Component Analysis

For the purposes of this Q methodology research, the PQMethod (Schmolck, 2014) software was used and a PCA was initially performed in order to identify meaningful factors. PCA was chosen over CFA because, as it was discussed in the previous paragraph, there is no sound theory underlying the variables (Q sorts) to be tested and the research aims more to explore for patterns of similarity among the variables. Moreover, CFA was also performed for comparison purposes and it was shown that PCA generated better results from a purely statistical point of view, which also “directed” the author of the thesis to finally opt for the PCA results.

A correlation matrix was created by the PQMethod software and it is illustrated in the following table.

**Table 2: Correlation matrix between Q sorts.**

| Q Sorts           | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10  | 11 | 12 | 13 |
|-------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|----|----|
| 1 Vesta Term.     | 100 | 51  | -2  | 32  | 30  | 38  | 23  | 8   | 20  | 41  | 42 | 41 | 38 |
| 2 CIEP            | 51  | 100 | 30  | 44  | 44  | 55  | 55  | 30  | 23  | 59  | 52 | 23 | 55 |
| 3 Q8              | -2  | 30  | 100 | 25  | 19  | 35  | 31  | 29  | 12  | 16  | 18 | 33 | 23 |
| 4 Min. Econ. Aff. | 32  | 44  | 25  | 100 | 25  | 31  | 36  | 34  | 37  | 43  | 36 | 32 | 37 |
| 5 Shell           | 30  | 44  | 19  | 25  | 100 | 52  | 28  | 36  | 13  | 35  | 50 | 9  | 18 |
| 6 COVA            | 38  | 55  | 35  | 31  | 52  | 100 | 53  | 21  | 25  | 63  | 61 | 35 | 42 |
| 7 ExxonMobil      | 23  | 55  | 31  | 36  | 28  | 53  | 100 | 23  | 36  | 50  | 40 | 30 | 48 |
| 8 EC/DG-En.       | 8   | 30  | 29  | 34  | 36  | 21  | 23  | 100 | 4   | 17  | 38 | 23 | 14 |
| 9 FuelsEurope     | 20  | 23  | 12  | 37  | 13  | 25  | 36  | 4   | 100 | 40  | -3 | 21 | 29 |
| 10 BP             | 41  | 59  | 16  | 43  | 35  | 63  | 50  | 17  | 40  | 100 | 51 | 20 | 48 |

|    |            |    |    |    |    |    |    |    |    |    |    |     |     |     |
|----|------------|----|----|----|----|----|----|----|----|----|----|-----|-----|-----|
| 11 | Cons. Firm | 42 | 52 | 18 | 36 | 50 | 61 | 40 | 38 | -3 | 51 | 100 | 29  | 32  |
| 12 | Hestya     | 41 | 23 | 33 | 32 | 9  | 35 | 30 | 23 | 21 | 20 | 29  | 100 | 28  |
| 13 | TU Delft   | 38 | 55 | 23 | 37 | 18 | 42 | 48 | 14 | 29 | 48 | 32  | 28  | 100 |

The interesting issue with this table is that it reveals who of the participants share similar ideas and perceive in the same way the drivers for corporate investments or divestments in the European downstream oil sector. Significant correlations between the Q sorts of different individuals reveal such a similarity pattern, and in the case of this research significant correlations are the ones  $> 0.40$ . The justification for this number for significance will be provided in due time.

Subsequently, the PQMethod software identified eight initial (unrotated) factors, which are all presented along with the factor loadings of every Q sort on each one of them in Appendix F (Table 1).

Three factors out of these eight were decided to be retained based on two criteria; (1) the Kaiser-Guttman (Guttman, 1954); (Kaiser, 1960) criterion which states that the researcher should retain only the factors with eigenvalues (EV) more than 1 and (2) the criterion of retaining factors if they have at least two significant loadings (Brown S. R., 1980). A significant factor loading at the 0.01 level ( $P < 0.01$ ) can be calculated by using the following equation (Brown S. R., 1980, pp. 222-3):

Significant factor loading =  $2.58 \times (1 \div \sqrt{\text{no. of items in Q set}}) \Rightarrow$

$$2.58 \times (1 \div \sqrt{42}) = 0.3981 \approx \pm 0.40$$

The first three unrotated factors satisfy both of these two criteria (see Appendix F, Table 1), so it was decided to keep them and discard completely the remaining five factors. Moreover, the first three factors “explain” a healthy 58% of the total variance ( $39\% + 10\% + 9\%$ ) in the data. Subsequently, these three factors were rotated using the Varimax method, in order to improve factor loadings. The Varimax rotation technique strives to ensure that every Q sort has a significant factor loading in relation to only one of the extracted factors. In the end Varimax aims to propose a factor solution which maximizes the amount of total variance explained (Watts & Stenner, 2012).

When this rotation procedure comes to an end, the PQMethod software generates the “final” factor matrix which illustrates the loadings of every Q sort on every factor extracted (see Appendix F, Table 3). It turned out that four of the respondents loaded significantly only on the first factor (Q sorts 4, 7, 9, 13), three loaded significantly only on the second factor (Q sorts 5, 6, 11), and finally two loaded significantly only on the third factor (Q sorts 3, 8). The weighted average of these Q sorts is used in every case to define the final “typical” Q sorts or Factors (Watts & Stenner, 2012). Moreover, four of the respondents (Q sorts 1, 2, 10, 12) loaded significantly on more than one factor (confounded Q sorts), and their Q sorts were not taken into account in the weighted average calculation for defining any of the final factors. These final factors constitute the different perspectives “hidden” in the Q sorts of the participants in this research, and their interpretation and the discussion about them will follow in the next Chapter.

## 5. Analysis of the results and discussion

The three extracted factors are in essence three “typical” Q sorts that can be perceived as three different viewpoints with respect to the topic of this research. These three factors can be, therefore, translated to the so-called factor arrays. A factor array is actually “a single Q sort configured to represent the viewpoint of a particular factor” (Watts & Stenner, 2012, p. 140). A factor array always follows the same distribution pattern as the one used in the original data collection. In this case for example, the factor arrays will allow for only two items to be positioned under or get “connected” to the -5 and +5 values of the relative scale expressing the degree of agreement, which was used in the interviews with the participants. The factor arrays are calculated by the PQMethod software and they can give a good overview of how participants evaluated the Q set items. The table with the factor arrays is presented below.

**Table 3: The factor arrays (Factor Q-sort values for each item).**

| No. | Item                                                                                                                                                                                                            | No. | Factor Arrays |    |    |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---------------|----|----|
|     |                                                                                                                                                                                                                 |     | 1             | 2  | 3  |
| 1   | The growing competition European refiners face from their Russian counterparts in the European market, works mostly as an incentive for upgrading investments in European refineries.                           | 1   | -2            | -5 | 1  |
| 2   | The fall of demand for gasoline in the US market is a significant driver for divestments in the European downstream oil sector.                                                                                 | 2   | 1             | 5  | 3  |
| 3   | A major driver for acquiring downstream assets in Europe is because is a good way to help to serve the growing demand for fuels in Asian countries.                                                             | 3   | -3            | -5 | -3 |
| 4   | Effective tax rates in Europe is an important driver for divestments in the European downstream oil sector.                                                                                                     | 4   | -1            | -3 | -2 |
| 5   | The high taxes on emissions in Europe is a major driver for divestments of refining assets.                                                                                                                     | 5   | 3             | 0  | -4 |
| 6   | Changes in supply and demand patterns in Europe is a major reason for acquisitions of storage facilities or conversion of refining facilities to storage in the region, to help handle the new commodity flows. | 6   | 2             | 5  | -2 |
| 7   | The need to comply with the European environmental legislation (including biofuels mandates), works mostly as an incentive for upgrading investments in refineries.                                             | 7   | -5            | 1  | 3  |
| 8   | Acquisitions of less profitable downstream assets in Europe, are justified for reasons of extended (foreign) policy reach through energy market control.                                                        | 8   | -1            | 0  | 4  |
| 9   | Retaining sufficient refining capacity in Europe is a key factor for the region's energy security.                                                                                                              | 9   | 5             | 2  | 0  |
| 10  | The Compulsory Stock Obligation (CSO) represents a cost for the industry, as it does not allow it to run down its stocks to the lowest level consistent with its operational requirements.                      | 10  | 2             | -4 | 0  |
| 11  | The substantial surplus of refining capacity in Europe can only lead to divestments of refining assets.                                                                                                         | 11  | 5             | 4  | 4  |
| 12  | Political pressure by European governments and labor unions on companies, is an important barrier for divestments of their uneconomic or poorly performing assets in Europe.                                    | 12  | 0             | 1  | 0  |
| 13  | The growing competition European refiners face from their US counterparts worldwide, works mostly as an incentive for upgrading and expansion investments in European refineries.                               | 13  | 2             | -4 | -4 |
| 14  | A major reason for exiting the refining business in Europe is the strong labor laws and high wages.                                                                                                             | 14  | 1             | 0  | -3 |

|    |                                                                                                                                                                                                                                       |    |    |    |    |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----|----|----|
| 15 | Most European refineries are configured to produce gasoline, however the European market demands more middle distillates, which is a major driver for upgrading investments in refineries.                                            | 15 | 3  | 1  | 5  |
| 16 | A major reason for acquiring storage facilities or converting refineries to storage in Europe, is compliance with compulsory stock obligations.                                                                                       | 16 | -5 | -2 | -1 |
| 17 | Acquisitions of refineries in Europe, is a good way to secure downstream outlets for your crude oil production and have a more efficient planning of output over time.                                                                | 17 | -2 | 0  | 3  |
| 18 | European refiners should invest more in chemical operations, as they will be able to offer a broader slate of products which can cushion against market-demand swings for fuel products.                                              | 18 | 3  | 1  | 1  |
| 19 | The current oversupply in the market will end, as smaller refineries close, therefore acquisitions of refineries in Europe can be justified.                                                                                          | 19 | 0  | -4 | -1 |
| 20 | The higher volatility and lower returns from investments downstream, than the ones from investments upstream (crude oil production), are a major driver for divestments of downstream assets in Europe.                               | 20 | 3  | 4  | 1  |
| 21 | Acquisition of midstream fixed logistic assets leads to better and faster exploitation of arbitrage opportunities.                                                                                                                    | 21 | -1 | 4  | -1 |
| 22 | A major reason for acquiring refineries and/or storage facilities in Europe, is the region's strategic location which offers global connectivity and increased trading potential.                                                     | 22 | -2 | -1 | 2  |
| 23 | The declining North Sea production and Urals availability, combined with increased future availability of other crude blends, is a good reason to invest in changing the European refineries configuration.                           | 23 | -1 | 0  | 2  |
| 24 | Local opposition is a major barrier for expanding or upgrading refining facilities in Europe.                                                                                                                                         | 24 | 0  | -3 | -5 |
| 25 | European refineries cannot compete with the new refineries in Asia and Middle East, as the latter are of high complexity and scale, and this works mostly as a driver for upgrading and expansion investments in European refineries. | 25 | 4  | -2 | 0  |
| 26 | Weak corporate balance sheets and the difficulty to access credit is a major barrier for investments in the European refining sector.                                                                                                 | 26 | 1  | -2 | 5  |
| 27 | A major driver for acquiring refineries in Europe is that you can gain a foothold in the region, without having to invest huge capital as many refineries are for sale at favorable prices.                                           | 27 | 2  | 3  | 2  |
| 28 | A major reason for divesting downstream assets is to boost the stock price and/or increase dividend payments to shareholders.                                                                                                         | 28 | 0  | 3  | -4 |
| 29 | A major reason for acquiring European refineries and converting them to storage facilities for trading purposes, is that an established site simplifies compliance for environmental regulations.                                     | 29 | -3 | 2  | -1 |
| 30 | Investments in the European refining sector are important for job creation purposes.                                                                                                                                                  | 30 | 1  | -1 | 1  |
| 31 | A major reason for converting unprofitable European refineries to terminals is mitigation of potential closure costs (including environmental, demolition, employee compensation and legal costs).                                    | 31 | 4  | 3  | 4  |
| 32 | A major reason for converting unprofitable European refineries to terminals is reduction of the plants' costs and release of working capital.                                                                                         | 32 | -4 | 2  | 2  |
| 33 | The ownership of midstream physical assets in Europe and the creation of end-to-end supply chains open opportunities to gain access to exclusive and unpublished market information.                                                  | 33 | 0  | 0  | -3 |
| 34 | The increasing activity from independent retailers/distributors and hypermarkets, is a major reason for acquiring storage facilities or converting refining facilities to storage in Europe.                                          | 34 | -2 | -2 | 0  |
| 35 | The mature European downstream market makes attractive the option to divest downstream assets in Europe and refocus on a strong downstream presence in other growth markets.                                                          | 35 | 4  | 1  | 3  |
| 36 | An important reason for investing in the European downstream sector is risk and overheads spreading, as well as hedging against currency fluctuations.                                                                                | 36 | -3 | -3 | -3 |

|    |                                                                                                                                                                                                                   |    |    |    |    |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----|----|----|
| 37 | The JVs of oil companies in the refining sector of non-European countries, help them shut refinery capacity in Europe and supply their wholesale and retail European networks with products from these countries. | 37 | -1 | -1 | -3 |
| 38 | Asset light strategies are preferred in Western Europe, due to the region's liquidity in petroleum products, good infrastructure, low refining margins and inadequate raw materials base.                         | 38 | 0  | 3  | 0  |
| 39 | The emergence of numerous traders, who have facilitated a liquid and competitive market for crude oil and refined products, makes downstream vertical disintegration attractive for oil companies.                | 39 | 1  | 2  | 1  |
| 40 | The higher freight costs for moving refined products to Europe from outside the region, than the costs for moving crude oil, is a major reason for investments in refineries located in Europe.                   | 40 | -4 | -1 | -1 |
| 41 | Asset-heavy strategies are becoming attractive because of the rise of financing and transaction costs due to regulatory changes in the banking and derivatives-trading environment.                               | 41 | -4 | -3 | -5 |
| 42 | A major reason for acquiring assets in the European downstream oil sector is for accessing new skills and capabilities in specific businesses within the oil value chain, for example oil products marketing.     | 42 | -3 | -1 | -3 |

The PQMethod software can create the factor arrays by ranking the Q set items based on the calculation of z-scores for every each one of the items, and for every factor. These z-scores allow for cross-factor comparisons, as the researcher can better understand how differently every item is evaluated from every factor. The z-scores for the items of every factor are presented in Appendix F of this report.

The factor arrays presented above allow for a first glimpse on the items that received the higher and lower scores from the participants. So, based on the factor arrays and z-scores of items, Factor 1 (or perspective 1) shows items 9, 11, 25, 35, 31 receiving the highest positive scores and items 16, 7, 41, 32, 40 receiving the lowest scores. For Factor 2, items 6, 2, 21, 11, 20 received the best scores while items 3, 1, 19, 10, 13 received the worst scores. Finally, items 15, 26, 11, 8, 31 were ranked at the highest position in Factor 3 array, whereas items 24, 41, 5, 13, 28 were ranked at the lowest position by the participants. These items are very useful in interpreting the factors, together with other unique items which distinguish most between a factor and the other factors. The latter are called distinguishing items and are actually items that a specific factor has ranked in a significantly different way to all the other factors (Watts & Stenner, 2012). They are also reported by the PQMethod and they will be presented in the subsequent paragraphs.

Altogether, the aforementioned items will be the starting point of the factor interpretation. The analysis continues with the presentation of every factor individually. Next, there is a presentation of the significant loadings of participants on every factor, and this is followed by presenting the areas of consensus or disagreement, between the factors and consequently between the participants' opinions about the research topic. Furthermore, the findings of the research are further analyzed and discussed in the discussion paragraphs, where the qualitative information extracted from all the participants is also used and highlighted.

## 5.1 Extracted Factors

### 5.1.1 Factor 1

The items that received the highest and lowest scores in Factor 1 array are presented below. Moreover, these items are accompanied by the distinguishing items as provided by the PQMethod, which are written in *italics*, and their scores in Factor 1 array are illustrated in the parentheses next to them. Last

but not least, the discussion about Factor 1 takes into account also the items that received the highest and the lowest scores in Factor 1 array, than in any other Factor arrays (Watts & Stenner, 2012). The latter items are not presented at this point, but a detailed list of all the items used for the discussion about Factor 1 can be found in Appendix G of this report.

#### ***Agree (+5)***

*9: Retaining sufficient refining capacity in Europe is a key factor for the region's energy security.*

11: The substantial surplus of refining capacity in Europe can only lead to divestments of refining assets.

#### ***Agree (+4)***

*25: European refineries cannot compete with the new refineries in Asia and Middle East, as the latter are of high complexity and scale, and this works mostly as a driver for upgrading and expansion investments in European refineries.*

31: A major reason for converting unprofitable European refineries to terminals is mitigation of potential closure costs (including environmental, demolition, employee compensation and legal costs).

35: The mature European downstream market makes attractive the option to divest downstream assets in Europe and refocus on a strong downstream presence in other growth markets.

#### ***Disagree (-5)***

*7: The need to comply with the European environmental legislation (including biofuels mandates), works mostly as an incentive for upgrading investments in refineries.*

*16: A major reason for acquiring storage facilities or converting refineries to storage in Europe, is compliance with compulsory stock obligations.*

#### ***Disagree (-4)***

*32: A major reason for converting unprofitable European refineries to terminals is reduction of the plants' costs and release of working capital.*

*40: The higher freight costs for moving refined products to Europe from outside the region, than the costs for moving crude oil, is a major reason for investments in refineries located in Europe.*

41: Asset-heavy strategies are becoming attractive because of the rise of financing and transaction costs due to regulatory changes in the banking and derivatives-trading environment.

#### ***Other distinguishing items***

*15: Most European refineries are configured to produce gasoline, however the European market demands more middle distillates, which is a major driver for upgrading investments in refineries. (+3)*

*5: The high taxes on emissions in Europe is a major driver for divestments of refining assets. (+3)*

*18: European refiners should invest more in chemical operations, as they will be able to offer a broader slate of products which can cushion against market-demand swings for fuel products. (+3)*

*6: Changes in supply and demand patterns in Europe is a major reason for acquisitions of storage facilities or conversion of refining facilities to storage in the region, to help handle the new commodity flows. (+2)*

*13: The growing competition European refiners face from their US counterparts worldwide, works mostly as an incentive for upgrading and expansion investments in European refineries. (+2)*

*26: Weak corporate balance sheets and the difficulty to access credit is a major barrier for investments in the European refining sector. (+1)*

*2: The fall of demand for gasoline in the US market is a significant driver for divestments in the European downstream oil sector. (+1)*

*24: Local opposition is a major barrier for expanding or upgrading refining facilities in Europe. (0)*

### **Discussion about Factor 1**

Factor 1 explains 21% of the total variance in the data. This perspective illustrates a strong concern about maintaining the right balance between Europe's energy security and the inevitable future shut downs of refining capacity in the region (9: +5, 11: +5). In terms of investments in refineries, the competition from Asia and the Middle East is considered as an important driver (25: +4), while competition from the US has also the same effect, although to a lesser extent (13: +2). Another important driver for upgrading investments is the current demand for middle distillates in the market, where there is an oversupply of gasoline (15: +3). Moreover, the benefits of integration between refining and petrochemicals are also acknowledged as a serious driver for investments (18: +3). Nevertheless, the financial difficulties of some companies involved in the European refining sector, are perceived as a barrier for further investments, although this is believed to be more an exception and not a rule (26: +1). What is also noteworthy is that this perspective attaches low value to drivers for acquisitions of refineries, such as securing outlets for crude oil production and having a more efficient planning over time (17: -2). Likewise, Europe's location and the global connectivity and trading potential it offers, are not believed to be major drivers for acquisitions of refineries and/or storage assets in the region (22: -2).

On the other hand, this perspective identifies several important drivers for divestments in the European downstream oil sector; the first is the related to the mature market in Europe, which makes attractive for some companies to divest in this region and refocus on their downstream presence in other growth markets (35: +4). A second serious reason for divestments of refining assets in Europe, is the high taxes on emissions (5: +3), while a relatively less important driver is perceived to be the fall of demand for gasoline in the US market (2: +1). What is also an important driver for divestments of refineries in Europe is the environmental legislation burden, which is not believed to be stimulating upgrading investments but rather having opposite effects (7: -5). In principle, this perspective does not consider asset-heavy strategies as attractive, despite of the regulatory changes in the banking and derivatives-trading environment (41: -4). Furthermore, what used to be the case, namely the higher freight costs for moving refined products to Europe from outside the region than the costs for moving crude oil, which in turn was a good reason to invest in refineries in Europe, is not considered to be valid nowadays (40: -4).

When it comes to storage assets, this perspective considers the mitigation of closure costs as the most important driver behind conversions of underperforming refineries (31: +4). At the same time it sees acquisitions of storage assets or conversions of refineries, as a good way to help handling the new commodity flows reaching Europe, due to the changes in supply and demand patterns in the region (6: +2). On the contrary, although CSOs is believed to represent a cost for the industry, up to a certain extent (10: +2), it is not considered to be a major reason for acquiring storage assets or converting

refineries to storage, for compliance purposes (16: -5). Moreover, this perspective does not share the opinion that conversions of unprofitable refineries in Europe are mainly performed for reasons of plants' costs reduction and of working capital release (32: -4), nor that a serious rationale for acquiring and converting an existing refinery to storage for trading purposes is that the site simplifies compliance for environmental regulations (29: -3).

Last but not least, it is interesting to comment that this perspective is neutral when it comes to consider local opposition as a barrier for expanding or upgrading refining facilities in Europe (24: 0). This is important because it illustrates an "averaged" opinion, where both agreement and disagreement with this item exist among the participants, rather than simple neutrality or indifference, as it was confirmed by the questions asked during the interviews.

### 5.1.2 Factor 2

The most important items related to Factor 2 array are presented below, in a similar way as it was conducted for Factor 1 array. A detailed list of all the items used for the discussion about Factor 2 can be found in Appendix G of this report.

#### ***Agree (+5)***

2: The fall of demand for gasoline in the US market is a significant driver for divestments in the European downstream oil sector.

6: *Changes in supply and demand patterns in Europe is a major reason for acquisitions of storage facilities or conversion of refining facilities to storage in the region, to help handle the new commodity flows.*

#### ***Agree (+4)***

11: The substantial surplus of refining capacity in Europe can only lead to divestments of refining assets.

20: Acquisition of midstream fixed logistic assets leads to better and faster exploitation of arbitrage opportunities.

21: *The higher volatility and lower returns from investments downstream, than the ones from investments upstream (crude oil production), are a major driver for divestments of downstream assets in Europe.*

#### ***Disagree (-5)***

1: *The growing competition European refiners face from their Russian counterparts in the European market, works mostly as an incentive for upgrading investments in European refineries.*

3: *A major driver for acquiring downstream assets in Europe is because is a good way to help to serve the growing demand for fuels in Asian countries.*

#### ***Disagree (-4)***

10: *The Compulsory Stock Obligation (CSO) represents a cost for the industry, as it does not allow it to run down its stocks to the lowest level consistent with its operational requirements.*

13: The growing competition European refiners face from their US counterparts worldwide, works mostly as an incentive for upgrading and expansion investments in European refineries.

19: The current oversupply in the market will end, as smaller refineries close, therefore acquisitions of refineries in Europe can be justified.

### **Other distinguishing items**

28: A major reason for divesting downstream assets is to boost the stock price and/or increase dividend payments to shareholders. (+3)

38: Asset light strategies are preferred in Western Europe, due to the region's liquidity in petroleum products, good infrastructure, low refining margins and inadequate raw materials base. (+3)

29: A major reason for acquiring European refineries and converting them to storage facilities for trading purposes, is that an established site simplifies compliance for environmental regulations. (+2)

15: Most European refineries are configured to produce gasoline, however the European market demands more middle distillates, which is a major driver for upgrading investments in refineries. (+1)

35: The mature European downstream market makes attractive the option to divest downstream assets in Europe and refocus on a strong downstream presence in other growth markets. (+1)

5: The high taxes on emissions in Europe is a major driver for divestments of refining assets. (0)

26: Weak corporate balance sheets and the difficulty to access credit is a major barrier for investments in the European refining sector. (-2)

24: Local opposition is a major barrier for expanding or upgrading refining facilities in Europe. (-3)

### **Discussion about Factor 2**

Factor 2 explains 25% of the total variance in the data. The perspective this Factor exemplifies, is heavily concerned with drivers for divestments of downstream assets in the European oil sector. First of all, it considers the fall of demand for gasoline in the US market as one of the most important reasons for divestments in the sector (2: +5), while a contributing factor to more divestments is considered the surplus of refining capacity in Europe (11: +4). Then, another driver is actually the higher returns and lower volatility from investments upstream than the ones downstream, which make oil firms to consider divestments of downstream assets in Europe (21: +4). Financial considerations, such as boosting the stock price and/or increasing dividend payments to shareholders, are also an important reason for divestments of downstream assets (28: +3), however taxation on corporate income in Europe is not believed to be a contributing factor to further divestments in the European downstream oil sector (4: -3). It is noteworthy to mention that this perspective considers external competition for the European refining sector, mostly as a driver for divestments and not for investments. So for example, competition from both Russia (1: -5) and the US (13: -4), is not perceived as a driver for upgrading and expansion investments in European refineries. Next to this, competition from Asia and Middle East is also working in the same way, although this case is less supported than the previous two (25: -2). The option to divest downstream assets in Europe in order to focus on a stronger downstream presence in other growth market, is also seen as a driver for divestments, but it is not a major one (35: +1). The fact that this perspective "sees" a lot of divestments can also be supported from the disagreement about the attractiveness of asset-heavy strategies in the sector, despite of the rise of costs due to regulatory changes (41: -3), along with the agreement on the preference for asset-light strategies particularly in Western Europe (38: +3). It is also interesting to mention that this perspective is rather pessimistic about the oversupply currently in the market and the future of the sector (19: -4), however it remains neutral when it comes to blame the emissions taxation in Europe for the divestments of refining assets (5: 0). It also maintains the idea that the increasing presence of trading companies in the

European downstream oil sector and the creation of very liquid markets, has “facilitated” up to a certain level, the downstream vertical disintegration for many oil companies (39: +2). Last but not least, it does not consider CSOs as a cost for the industry at all (10: -4).

In terms of investments in the downstream sector in Europe, there are fewer remarkable results to mention. The fact that many European refineries are for sale at low prices, offers the possibility to gain a foothold in the region without spending a large amount of capital, and this is perceived as a good driver for acquisitions of refineries (27: +3). On the other hand, a strategy to serve the Asian fuels markets will not include acquisitions of downstream assets in Europe (3: -5). Furthermore, accessing new skills and know-how in specific businesses within the oil value chain, is not considered a major driver for acquisitions of downstream assets in Europe, although it might occur exceptionally (42: -1). In terms of market demand for fuels, the gasoline surplus in Europe and the need for more middle distillates is perceived as a factor stimulating upgrading investments in refineries but not to a large extent (15: +1). It is interesting to note that this perspective does not see many reasons for investments in the European refining sector, but at the same time it considers that neither financial conditions nor local opposition are major barriers for these investments (26: -2, 24: -3).

When it comes to acquisitions of midstream assets and conversion of refineries to storage in Europe, a major driver is perceived to be the changes in supply and demand patterns in the region and the need to handle the new commodity flows (6: +5). Acquisitions of midstream assets particularly, lead to better and faster exploitation of arbitrage opportunities (20: +4), while conversions of refineries are often driven by the need to mitigate potential closure costs (31: +3). Moreover, acquisitions and conversions of refineries are less often driven by the fact that established sites simplify compliance with environmental regulations, if the sites are destined to be used for trading purposes (29: +2).

### 5.1.3 Factor 3

The most important items related to Factor 3 array are presented below, in a similar way as it was conducted for the previous Factor arrays. A detailed list of all the items used for the discussion about Factor 3 can be found in Appendix G of this report.

#### **Agree (+5)**

*15: Most European refineries are configured to produce gasoline, however the European market demands more middle distillates, which is a major driver for upgrading investments in refineries.*

*26: Weak corporate balance sheets and the difficulty to access credit is a major barrier for investments in the European refining sector.*

#### **Agree (+4)**

*8: Acquisitions of less profitable downstream assets in Europe, is justified for reasons of extended (foreign) policy reach through energy market control.*

*11: The substantial surplus of refining capacity in Europe can only lead to divestments of refining assets.*

*31: A major reason for converting unprofitable European refineries to terminals is mitigation of potential closure costs (including environmental, demolition, employee compensation and legal costs).*

#### **Disagree (-5)**

24: Local opposition is a major barrier for expanding or upgrading refining facilities in Europe.

41: Asset-heavy strategies are becoming attractive because of the rise of financing and transaction costs due to regulatory changes in the banking and derivatives-trading environment.

#### **Disagree (-4)**

5: The high taxes on emissions in Europe is a major driver for divestments of refining assets.

13: The growing competition European refiners face from their US counterparts worldwide, works mostly as an incentive for upgrading and expansion investments in European refineries.

28: A major reason for divesting downstream assets is to boost the stock price and/or increase dividend payments to shareholders.

#### **Other distinguishing items**

17: Acquisitions of refineries in Europe, is a good way to secure downstream outlets for your crude oil production and have a more efficient planning of output over time. (+3)

22: A major reason for acquiring refineries and/or storage facilities in Europe, is the region's strategic location which offers global connectivity and increased trading potential. (+2)

6: Changes in supply and demand patterns in Europe is a major reason for acquisitions of storage facilities or conversion of refining facilities to storage in the region, to help handle the new commodity flows. (-2)

### **Discussion about Factor 3**

Factor 3 explains 13% of total variance in the data. According to this point of view, a major driver for upgrading investments in European refineries is that they are gasoline-heavy while the market demands more middle distillates (15: +5). However, there is a major barrier for investments in the European refining sector, namely the weak financial shape of many firms and their difficulties to access credit (26: +5). On the contrary, local opposition is not at all considered an inhibiting factor for expansions or upgrading investments in European refineries (24: -5), while the need to comply with European environmental legislation is stimulating upgrading investments (7: +3). Another, less important, driver for upgrading investments in European refineries is the growing competition they are facing from their Russian counterparts (1: +1), while the declining availability of North Sea and Urals crudes along with the increasing supply of other crude blends, are leading to more investments in changing the European refineries configuration (23: +2). Concerning specifically acquisitions of downstream assets in Europe, it is remarkable that this perspective takes seriously into account any political considerations accompanying these transactions (8: +4), while at the same time it attaches a lot of value to the benefits achieved through refinery acquisitions in Europe, such as securing downstream outlets for crude production and having a more efficient planning of output over time (17: +3). A less important driver behind refineries and/or storage assets acquisitions is considered to be Europe's strategic location and the potential it offers for trading (22: +2).

When it comes to divestments of refining assets, a major driver behind them is considered to be the surplus of refining capacity in Europe which will inevitably lead to more divestments (11: +4), but on the contrary, taxes on emissions in Europe is not considered to be a major contributing factor (5: -4). The growing competition European refineries face from the US is perceived more as a driver for divestments of refining assets (13: -4). On the other hand, intention to boost a firm's stock price and/or

increase dividend payments to shareholders (28: -4) or the effect of strong labor laws and high wages in Europe (14: -3), are not considered to be serious reasons for divesting downstream assets or exiting the refining business in the region. In principle, more divestments of assets in the European downstream oil sector are to be expected, as asset-heavy strategies are becoming less attractive (41: -5). This perspective does not attach a lot of value to the argument of keeping sufficient refining capacity in Europe as a means to ensure the region's energy security (9: 0), and it does not agree that the JVs of oil companies in the refining sector of non-European countries will lead to more capacity closures in Europe (33: -3).

In terms of conversions of refineries and investments or divestments in storage assets, what perspective 3 sees is that a major reason for refinery conversions is the mitigation of potential closure costs (31: +4). However, it is remarkable to mention that the changes in supply and demand patterns in Europe and therefore the need to handle the new commodity flows, is not perceived to be a major driver for acquisitions of storage facilities or for converting underperforming refining assets to storage in the region (6: -2). Last but not least, getting access to exclusive and unpublished market information is certainly not believed to be a reason for acquiring midstream physical assets in Europe (37: -3).

## 5.2 Participants' loadings on each factor

At this point it is interesting to make a comment about the loadings of the participants on each factor extracted.

**Table 4: Participants' (significant) loadings on each factor.**

| No. | Participant's background | Factor 1 | Factor 2 | Factor 3 |
|-----|--------------------------|----------|----------|----------|
| 1   | Vesta Terminals          | x        | x        |          |
| 2   | CIEP                     | x        | x        |          |
| 3   | Q8                       |          |          | x        |
| 4   | Min. Econ. Aff.          | x        |          |          |
| 5   | Shell                    |          | x        |          |
| 6   | COVA                     |          | x        |          |
| 7   | ExxonMobil               | x        |          |          |
| 8   | EC/DG-En.                |          |          | x        |
| 9   | FuelsEurope              | x        |          |          |
| 10  | BP                       | x        | x        |          |
| 11  | Cons. Firm               |          | x        |          |
| 12  | Hestya                   | x        |          | x        |
| 13  | TU Delft                 | x        |          |          |

As it can be seen also in the previous table, there are 8 participants loading significantly on Factor 1, 6 participants loading significantly on Factor 2 and 3 participants loading significantly on Factor 3. The exact loadings can be seen in Table 3 in Appendix F. With respect to Factor 1, it is interesting to mention that the point of view of 2 participants from IOCs (ExxonMobil and BP) has many similarities with the point of view of the 2 participants who come from the group of traders, terminal operators and logistics providers (Vesta Terminals, Hestya), but also with the point of view of the participants from the Dutch Government (Ministry of Economic Affairs), from the industry side (FuelsEurope) and from research institutes and organizations (CIEP and TU Delft). This agreement between these participants is

noteworthy considering the rather diverse background they have. The loadings on Factor 2 illustrate that the participants from Vesta Terminals, from CIEP and from BP keep sharing similar points of view, but now their perspectives are largely in agreement with the perspectives of the participants related to Shell, COVA and an independent Consultancy Firm (CF). Last but not least, it is shown from Factor 3 loadings that interestingly enough, the point of view of the participant related to the European Commission (EC) has a lot in common with the one of the participant from a non-European NOC like Q8. Moreover, despite of the different backgrounds, these two participants largely agree with the participant from Hestya.

### 5.3 Areas of consensus and disagreement between the factors

The findings presented at this part of the report are very important, because they allow for a direct comparison between the extracted factors. The PQMethod software generates a table which illustrates the items which received similar scores in all factors (therefore were valued more or less in the same way by the participants), the so-called consensus items. Moreover, the software generates tables presenting an overview of these areas of consensus and disagreement for all factors, but also tables where every factor is compared to one other. So for the needs of this research, there are three direct comparisons provided by the software; Factor 1-Factor 2, Factor 1-Factor 3 and Factor 2-Factor 3. All of these tables can be found in the Appendix F of this report.

#### 5.3.1 Consensus between factors

The following table presents the items whose scores do not distinguish between any pair of factors, therefore these items were ranked similarly by all study factors, and therefore by all participants on average. It is important to mention that the consensus items presented here were ranked so similarly, that none of them is significant in a statistical sense. They are presented in a descending order in terms of consensus (calculated by the PQMethod by using the variance across factor z-scores). All these statements are non-significant at  $P > 0.01$ , and those flagged with an \* are also non-significant at  $P > 0.05$ .

**Table 5: Consensus items (those that do not distinguish between any pair of factors).**

| No. | Item                                                                                                                                                                                                              | No. | Factors              |                      |                      |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------------------|----------------------|----------------------|
|     |                                                                                                                                                                                                                   |     | 1<br>Q sort<br>value | 2<br>Q sort<br>value | 3<br>Q sort<br>value |
| 31* | A major reason for converting unprofitable European refineries to terminals is mitigation of potential closure costs (including environmental, demolition, employee compensation and legal costs).                | 31  | 4                    | 3                    | 4                    |
| 34* | The increasing activity from independent retailers/distributors and hypermarkets, is a major reason for acquiring storage facilities or converting refining facilities to storage in Europe.                      | 34  | -2                   | -2                   | 0                    |
| 37* | The JVs of oil companies in the refining sector of non-European countries, help them shut refinery capacity in Europe and supply their wholesale and retail European networks with products from these countries. | 37  | -1                   | -1                   | -3                   |

|     |                                                                                                                                                                                                               |    |    |    |    |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----|----|----|
| 36* | An important reason for investing in the European downstream sector is risk and overheads spreading, as well as hedging against currency fluctuations.                                                        | 36 | -3 | -3 | -3 |
| 11* | The substantial surplus of refining capacity in Europe can only lead to divestments of refining assets.                                                                                                       | 11 | 5  | 4  | 4  |
| 30* | Investments in the European refining sector are important for job creation purposes.                                                                                                                          | 30 | 1  | -1 | 1  |
| 12* | Political pressure by European governments and labor unions on companies, is an important barrier for divestments of their uneconomic or poorly performing assets in Europe.                                  | 12 | 0  | 1  | 0  |
| 27* | A major driver for acquiring refineries in Europe is that you can gain a foothold in the region, without having to invest huge capital as many refineries are for sale at favorable prices.                   | 27 | 2  | 3  | 2  |
| 42* | A major reason for acquiring assets in the European downstream oil sector is for accessing new skills and capabilities in specific businesses within the oil value chain, for example oil products marketing. | 42 | -3 | -1 | -3 |
| 39* | The emergence of numerous traders, who have facilitated a liquid and competitive market for crude oil and refined products, makes downstream vertical disintegration attractive for oil companies.            | 39 | 1  | 2  | 1  |
| 33* | The ownership of midstream physical assets in Europe and the creation of end-to-end supply chains open opportunities to gain access to exclusive and unpublished market information.                          | 33 | 0  | 0  | -3 |
| 4   | Effective tax rates in Europe is an important driver for divestments in the European downstream oil sector.                                                                                                   | 4  | -1 | -3 | -2 |
| 23* | The declining North Sea production and Urals availability, combined with increased future availability of other crude blends, is a good reason to invest in changing the European refineries configuration.   | 23 | -1 | 0  | 2  |
| 41* | Asset-heavy strategies are becoming attractive because of the rise of financing and transaction costs due to regulatory changes in the banking and derivatives-trading environment.                           | 41 | -4 | -3 | -5 |
| 40  | The higher freight costs for moving refined products to Europe from outside the region, than the costs for moving crude oil, is a major reason for investments in refineries located in Europe.               | 40 | -4 | -1 | -1 |
| 18  | European refiners should invest more in chemical operations, as they will be able to offer a broader slate of products which can cushion against market-demand swings for fuel products.                      | 18 | 3  | 1  | 1  |

As it can easily be noticed all participants strongly agree upon items 11 and 31, while they all also agree to a lesser extent, with items 18, 27 and 39. Then, there are items for which participants on average are more neutral, have mixed feelings or are indifferent about, like items 12, 23, 30 and 33. Concerning disagreement with the items, all participants on average strongly disagree with items 36, 41 and 42, while they all disagree but to a smaller degree with items 4, 34, 37 and 40 (although participants loading more on Factor 1 disagree more with item 40).

### 5.3.2 Disagreement between factors

As it was mentioned, the PQMethod software is listing not only the consensus items between the factors, but also gives an overview of the items for which there is disagreement between the factors. While the full table illustrating all of this information can be found in Appendix F of this report, the most controversial items are briefly referred to at this point. The next table presents the 10 items for which the most disagreement was noticed among the factors.

**Table 6: Controversial items.**

| No. | Item                                                                                                                                                                                                                                  | No. | 1<br>Q sort<br>value | Factors<br>2<br>Q sort<br>value | 3<br>Q sort<br>value |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------------------|---------------------------------|----------------------|
| 6   | Changes in supply and demand patterns in Europe is a major reason for acquisitions of storage facilities or conversion of refining facilities to storage in the region, to help handle the new commodity flows.                       | 6   | 2                    | 5                               | -2                   |
| 25  | European refineries cannot compete with the new refineries in Asia and Middle East, as the latter are of high complexity and scale, and this works mostly as a driver for upgrading and expansion investments in European refineries. | 25  | 4                    | -2                              | 0                    |
| 7   | The need to comply with the European environmental legislation (including biofuels mandates), works mostly as an incentive for upgrading investments in refineries.                                                                   | 7   | -5                   | 1                               | 3                    |
| 32  | A major reason for converting unprofitable European refineries to terminals is reduction of the plants' costs and release of working capital.                                                                                         | 32  | -4                   | 2                               | 2                    |
| 5   | The high taxes on emissions in Europe is a major driver for divestments of refining assets.                                                                                                                                           | 5   | 3                    | 0                               | -4                   |
| 26  | Weak corporate balance sheets and the difficulty to access credit is a major barrier for investments in the European refining sector.                                                                                                 | 26  | 1                    | -2                              | 5                    |
| 21  | Acquisition of midstream fixed logistic assets leads to better and faster exploitation of arbitrage opportunities.                                                                                                                    | 21  | -1                   | 4                               | -1                   |
| 9   | Retaining sufficient refining capacity in Europe is a key factor for the region's energy security.                                                                                                                                    | 9   | 5                    | 2                               | 0                    |
| 24  | Local opposition is a major barrier for expanding or upgrading refining facilities in Europe.                                                                                                                                         | 24  | 0                    | -3                              | -5                   |
| 13  | The growing competition European refiners face from their US counterparts worldwide, works mostly as an incentive for upgrading and expansion investments in European refineries.                                                     | 13  | 2                    | -4                              | -4                   |

At this point, the most valuable results generated by the PQMethod software have been presented. A discussion about these results follows in the next paragraphs.

## 5.4 Discussion

The information presented in the previous tables creates room for discussion not only about the items that all participants agreed or disagreed about, but it also about the diversity expressed in their opinions concerning the important drivers for investments or divestments in the European downstream oil sector. This diversity is reflected at the 3 different factors extracted, representing 3 different perspectives, and at the different loadings each participant had on every factor.

The research does not aim merely to identify the most important drivers for investments or divestments as they are perceived by the all the stakeholders, but it intends as well to maintain and highlight the diversity among their opinions. This is believed to be the only way to give a more complete picture about what stakeholders think about such a complex topic and provide a more comprehensive answer to the research (sub) questions of this study.

It is interesting to start with some of the results illustrated in tables 2 and 4, which can be used as an indicator of how much the participants' opinions hold in common. It should be mentioned as a reminder that significant correlations in this research are considered the ones which are  $> 0.40$  at the 0.01 level ( $P < 0.01$ ). What draws some attention from the tables is that the participant from Vesta Terminals shares quite similar ideas with the participant from Hestya, as it perhaps would be expected. However their responses do not have so many things in common (the correlation is marginally significant) as it could be anticipated. Furthermore, it is noteworthy that this correlation is the only significant one for the participant from Hestya, as it seems that he does not share many similar ideas with any of the other participants. Interestingly enough, the participant from Q8 has significant correlations with none of the other participants, maybe illustrating the different way of thinking which exists in (non-European) NOCs than in other types of companies or organizations. The author of the thesis would expect also to see a higher correlation between the participants from the Dutch Ministry of Economic Affairs and from the EC, but this was not verified. It is also remarkable that the participant related to Shell, did not correlate significantly with the other two individuals from IOCs, which by itself highlights the increased subjectivity among the responses. What is also interesting to notice is that the participant from COVA ranked the items of the research in a way which is very similar to how all 3 participants related to IOCs did it. When it comes to the point of view of a policy maker from the EC, it is noteworthy that it doesn't have many things in common with none of the other participants' points of view. This perhaps illustrates the rather different viewpoint of a policy maker, compared to the ones of the industry representatives. One more remark is that the individual from TU Delft shares many similar ideas with the participant from the CIEP, which perhaps can be explained from the fact that none of them has "vested interests" in the industry and they can view the dynamics of the sector from a distance.

More similarities or differences among the participants' viewpoints can be extracted and discussed from tables 5 and 6. In some cases, there may be an explanation behind these differences or similarities depending on the background of the participants or their role within the company or the organization they are associated with. Nevertheless, it is not necessary to give more examples in order to illustrate the diversity among the beliefs of participants even holding the same "profile", or the fact that in cases of existing similarities, these cannot easily be attributed to a particular common characteristic among participants. The diversity among opinions is self-evident and it usually does not allow for grouping the participants according to their responses. It seems therefore that every person bears its own ideas and beliefs, despite of the fact that these are undoubtedly affected to a certain extent by the environment this person belongs in. This was made visible also during the interviews with the participants, where in

many cases they were commenting about specific items from the point of view of the company or organization they are associated with, while in other cases their own –personal– point of view prevailed. These personal beliefs are the ones which generate the differences among the responses from people related to IOCs for example, even though they are all influenced to a certain extent by what their firm values or considers as important, so they inevitably share some similar ideas about certain factors. However, the number of participants also plays an important role here as, if there would have been involved in the research not only three but maybe six or more individuals related to IOCs, then it could be expected that the similarities among their responses would become more obvious. This comment does not concern only people from similar companies but it is applicable to all stakeholders interviewed in this research. It must be said though that in this research, any attempt to explain similarities between responses is based on some hypotheses about the participants' background; one example could be that all participants who do not have a “vested interest” in the business are expected to show similar points of view. However, due to the small representation, in the sample, of specific stakeholders' groups like NOCs or independent refiners for example, it is difficult to verify such hypotheses. Hence it is also difficult to claim that the differences or the similarities between the viewpoints of different stakeholders can be explained based on those hypotheses.

Having made this remark about the unequal representation of specific stakeholders in the sample, one more important issue has to be discussed; as it seems from the significant factor loadings of all the respondents on the factors extracted (see Table 4), it is not possible to claim that one of the factors reflects the ideas and beliefs of a specific group of stakeholders. In other words, it is not possible and it would not be valid to claim for example that one factor represents the viewpoint of all the people related to IOCs or of the policymakers. However, this is not considered to be a problem and it should not discourage the discussion about how people with different backgrounds perceive the investment/divestment drivers in different ways. The factors extracted still represent viewpoints of individuals and as explained, this research wants to take into account the diversity among these viewpoints.

Another important issue the author of this thesis would like to touch, is that most of the participants associated themselves with Factor 1 and 2, so it could be argued that the most or least important items from the Q set and consequently the most or least important investment/divestment drivers, are the ones considered as such by these two factors. After all, these two Factors explain 21% and 25% of the total variance in the data respectively, compared to only a 13% explained by Factor 3. It could be then argued that maybe Factor 3 is not a useful or meaningful factor to maintain. Nevertheless, the author of this thesis believes that is important to maintain the diversity among participants' responses and for this reason Factor 3 will not be discarded. Moreover, it is true that only three participants have significant factor loadings on Factor 3, however, it is reasonable to believe that if there would have been more respondents from NOCs, more traders/terminal operators or more policy makers, a larger number of participants would be loading significantly on this factor. That would definitely exemplify a third perspective on the issue at stake; the perspective of Factor 3. Additionally, it can be said that Factor 3 is indicative of what approximately would be the perspective of individuals associated with NOCs, traders/terminal operators or policy makers (none of the participants related to IOCs for example has significant factor loading on Factor 3), and had there been more participants from these stakeholders groups, that possibly would have been verified. Next to the previous considerations, it is always possible to assess whether a factor extracted by the PQMethod software should be retained, not only by the criteria mentioned in paragraph [4.4.1](#), but also by its correlations with the other factors extracted. If a correlation between two factors is exceeding the significance level ( $> 0.40$ ), it may be the

case that these two different factors are actually so similar that they should be considered as one (Watts & Stenner, 2012). In the case of this research there is no such issue present, as the inter-correlations between the extracted factors are all below the 0.40 threshold (see Table 6 in Appendix F).

It should be clear by now that although the three extracted factors are indeed useful because they represent three different perspectives of individuals, with respect to the most and least important drivers for investments/divestments in the European downstream oil sector. These perspectives cannot be associated with specific groups of stakeholders and this, combined with the underrepresentation of certain stakeholders, do not allow for continuing the discussion based of these three factors. This is in contrast with the usual practice in Q methodology research where the focus usually remains on the factors themselves. However, in the case of this research, the author believes that it would be very useful and meaningful, to focus on the specific items of the Q set. With the help of the qualitative information extracted from the interviews, a discussion about each of the items follows and this is believed to be the best way to illustrate all the diversity, but also the similarities among participants' responses. After all of the items have been presented and discussed, a summarizing paragraph will offer an overview of what counts and what not, with respect to the drivers for investments or divestments in the European downstream oil sector. This last paragraph is in essence the answer to the last research sub-question of this study.

The first step of the discussion is related to the items about which there was consensus among the participants. These items were presented in Table 5.

#### 5.4.1 Consensus among the participants' views

##### *Agreement with the items*

It is obvious from Table 5 that all participants consider that there is indeed a surplus or refining capacity in Europe and this will inevitably lead to further divestments of refining assets. Subsequently, all 3 Factors gave a high score to this item, with Factor 1 giving a +5 score and both Factors 2 and 3 giving a +4 score. Many participants consider that further refinery closures are not only inevitable in Europe, but also that they should happen. Of course, capacity reduction is perceived as necessary particularly when it is considered along with expectations for a declining future demand in Europe. The surplus of refining capacity in the region, combined with the increased competition for the European refining sector worldwide will lead to more divestments of refining assets, and the first candidates will be the small, simple and not well-located plants. After all, this is perceived as the only way European refineries can improve their margins, as the short-term solution of lower crude throughputs reduces on the one hand the production of gasoline, but on the other hand it also reduces the production of diesel. Thus, in the end this solution is not improving refining margins and the only viable alternative is more refinery closures. In addition, the fact that some traders or some Russian, Chinese and Indian players are entering the refining business in Europe, for their own reasons, is actually worsening the refining margins in the region and delaying the solution to the problem of overcapacity. In the end, this situation is not believed to be sustainable and in the long run even these players maybe will want to re-sell their refining assets or maybe will have to shut them down.

Then, all participants expressed their agreement with item 31: "A major reason for converting unprofitable European refineries to terminals is mitigation of potential closure costs (including environmental, demolition, employee compensation and legal costs)". The general agreement of participants is also reflected from the +4, +3 and +4 scores this item received in Factor 1, Factor 2 and

Factor 3 arrays respectively. Participants emphasized the importance of closure costs, which by far outweigh the costs of maintaining a storage facility. Therefore, conversions of unprofitable refineries is indeed perceived as a good way to “postpone” the high costs of closing down a plant and decommissioning it, but also to get the most possible value out of the asset and extend its lifetime. As a matter of fact, the participant from BP stressed his agreement with this item by mentioning that he is not aware of any refinery in Europe being shut down completely and decommissioned, with the land being given back to the local community.

One of the arguments many participants slightly agreed with or remained relatively neutral about, is No. 18 which refers to the benefits of chemical operations for refiners and considers these benefits as an important investment driver in petrochemical units. This argument received a +3 score in Factor 1 array and a +1 score in both Factor and 3 arrays. Several participants confirmed that indeed, possessing a refinery integrated with petrochemicals, translates to business diversification, which in turn offers more protection from market demand fluctuations for fuel products. More diversification means exposure across more markets and therefore, decreased vulnerability to specific market downturns. However, the potential benefits from integration, do not mean that all European refiners can and should invest in petrochemicals. What is important before taking such an investment decision as a company, is to assess your skills and try to evaluate if you can do better than your competitors in the petrochemicals market. Besides, small, simple and not well-located refineries, are unlikely to be attractive targets for integration with petrochemicals. Moreover, the petrochemicals sector is currently facing pressures similar to the ones of the oil sector, which makes investment decisions more difficult to be made. As the participant related to BP added, one of the drivers for investments in chemical operations is the price of natural gas. This practically means that these investments are more difficult to be made in Europe due the relatively higher natural gas prices, compared to the prices in the US. The business climate in Europe does not really provide the incentives to invest. In the end, if a refinery nowadays is already integrated with a petrochemical plant or is positioned in the same cluster with petrochemical units, it enjoys the synergies developed and it has an advantageous position. However new investments in petrochemical units are tough to be made.

When it comes to acquisitions of cheap refineries in Europe, for reasons of gaining a foothold in the region at a low cost, there was a large number of participants remaining more neutral or slightly agreeing with this argument. The scores this argument received is a +2 in Factor 1 and Factor 3 arrays, and a +3 in Factor 3 array. Several participants recognized that this is something which has happened, particularly with companies from Russia and Asia. Moreover, they consider that this is not a stand-alone reason for acquiring European refineries at a low cost, but it is accompanied by strategies of gaining access to downstream assets for becoming more vertically integrated. In the end, what it seems to hold true in many participants' views, is that the companies acquiring these assets perceive in them good business opportunities for profit creation, and other strategic considerations come secondly when they are deciding about these acquisitions. However, agreement of participants with this item is largely driven by noticing what kind of companies have been seen acquiring these refining assets, hence this item may be true only for these limited amount of non-European companies. Last but not least, it is important to mention that none of the participants is related to a company which has proceeded to a refinery acquisition of this type (cheap refinery which wouldn't be bought only for economic reasons), so different considerations about this item may not be available to the thesis author.

Furthermore, participants remained neutral on average about the argument which states that emergence of numerous traders, who have facilitated a liquid and competitive market for crude oil and refined products, makes downstream vertical disintegration attractive for oil companies. The only

participant who strongly agreed with this argument is related to TU Delft. The scores of this argument were a +1 in Factor 1 and 3 arrays, and a +2 in Factor 2 array. It was acknowledged by the participants that this is something which is happening and there are examples of firms splitting up, also because of the increased liquidity in the market. Indeed, the market is more liquid nowadays than it has ever been before, however according to some participants' point of view this works more as a facilitator for vertical disintegration than as a driver. In a way, it allows firms to do it. Moreover, despite the low refining margins in the European refining business, asset-light trading activities are possible and the more traders are attracted the more pressure the margins have. As the participant from TU Delft put it, it is like a self-fulfilling prophecy. Nevertheless, the increased presence of trading companies brings also some relief to the gasoline-diesel misbalance problems of the sector, as markets are increasingly becoming supplied by traders and not by refiners. Traders are taking over the refiners' supply business in a sense, and the consequences of this pattern still remain to be seen.

### *Neutrality and/or mixed feelings about the items*

Concerning the political pressure by European governments and labor unions on companies to prevent divestments of their uneconomic or poorly performing assets in Europe, many participants found difficult to judge on a pan-European level and they took on average a more neutral position about this. The participant who agreed the most with this argument is related to Vesta Terminals and the one who agreed the least is related to BP. The argument itself received a 0 score in Factor 1 and 3 arrays, and a +1 score in Factor 1 array. The main reason for the neutrality of participants is that the situation differs per country, since in some European countries the political influence in the industry and therefore in the oil sector as well, is more to be seen than in other countries and the power of labor unions also varies greatly. In cases where the government is backing up the refining sector, the decisions about divestments of assets are largely influenced by political and not only by economic considerations. Furthermore, even in countries where governments and labor unions are putting a lot of pressure against divestments, the latter have actually occurred, so it is difficult to assess the impact of these pressures. In the end, if assets are unprofitable, they will eventually have to be divested because it is not sustainable to keep them "alive" by continuously putting money there as a government or as a NOC. It is true that a government or a NOC may be taking investments decisions based on different criteria than a purely private firm, nevertheless there will always be a point where it will be just so much cheaper to buy products from the market, than to keep putting money in a non-worthy asset, where divestments are inevitable.

When it comes to the changing patterns of crude oil supply, where North Sea productions and Urals availability are declining, some of the participants mentioned that this is indeed a driver for investments or also divestments. The argument received a -1 score in Factor 1 array, a 0 score in Factor 2 array and a +2 score in Factor 3 array. The participants who agreed the most with it are related to Hestya and the EC, while the people from BP and Fuels Europe agreed the least. In principle, participants do not attach a lot of value on the importance of this argument because they consider the developments in the crude oil supply, as only one of the numerous factors affecting the business in Europe. In the end, the declining production of North Sea and Urals is perceived to be exemplifying the nature of the refining business, which demands continuous adaptation to changes and to the environment dynamics.

Job creation as a driver for investments in the European refining sector, is an argument which is often used by firms in this business, since there is a certain number of people employed directly but also

indirectly. Participants commented that job creation can be indeed considered as a driver for investments but not as a major one, and this “neutrality” is reflected in the scores this argument received in all Factor arrays (+1, -1, +1). The participant who gave the highest agreement score to this argument is from ExxonMobil, while the one who gave the lowest score is from the Consultancy Firm (CF). The reason this driver is not a major one is that the refining industry is not really a labor intensive industry, and the truth is that most of the job creation occurs during the construction period of a new project, but after this period, not many employees are required to keep running a refining unit. The participant from the CF even mentioned that due to the low number of new jobs created when an investment is made for expanding or upgrading a refinery, it would be of more concern to assess how it is possible to maintain the European refining sector for maintaining the existing jobs, rather than trying to create new ones by investing large amounts of capital. Moreover, due to the structural problems of the refining industry in Europe, even many of the existing jobs are not sustainable, so investing in this industry for job creation purposes will be a way to delay solving the problems of the industry. It would be more important for all the stakeholders to investigate ways to create sustainable employment in another sector. On the other hand, with investments there is still some job creation and especially high-level job creation, for well-educated people who are usually also well-paid. This in turn creates a multiplier effect as these people are spending their salary on other things, outside of the context of the refining sector, “creating” more jobs. Furthermore, some jobs are created as well in a secondary way in the refining business, as there is always a need for maintenance, services etc. An interesting comment was made from the participant related to ExxonMobil about the relation between the refining sector and the chemical sector, and about how the former is a key for having the latter because of the integration between them. It was stressed that if Europe will lose its refining sector, there will be a loss of jobs in both the refining sector and the petrochemicals sectors, and there is still a significant amount of people employed by the chemical industry. When it comes to involve governments in this discussion, it is obvious that job creation considerations for them are of a higher importance, because the issue of job creation is directly related to social rest and hence, investment decisions may be made differently when serious political pressures are present. Furthermore, these pressures differ among European countries according to the local situation. For example in France and Germany, because of car-factories closures, extra social pressure is added to politicians for labor creation in the oil industry. Last but not least, for European governments, investing in the refining sector is not only a way to create jobs but also a way of securing their economic perspectives, as the refining assets need to be maintained and investments on a regular basis are necessary.

The last argument about which there were more neutral or even a bit negative feelings from the participants, sees the ownership of midstream physical assets in Europe and the creation of end-to-end supply chains as a way to gain access to exclusive and unpublished market information. The participants related to Vesta Terminals, Hestya, TU Delft and the EC, strongly disagreed with this argument and gave it a low score. Gaining access to information is not perceived as a driver for investments in midstream assets, at least not in Europe. That used to be the case, maybe 20 or 30 years ago, but nowadays market information is the same for everybody, and this is actually one of the biggest problems traders face. Moreover, information can be bought and there is no real need to own assets for accessing it. Simply by renting assets such as tanks, it's possible to have this information. Nevertheless, all traders, even paper traders, need to be in the physical markets in order to possess the market information, but they can merely rent tanks to do so; there is no need to acquire them. It is interesting that this situation stands also for refiners, as there are a number of specialized companies which are selling the necessary market information. As soon as a refiner starts collaborating with such a company, it's possible to gain access to information about the whole sector. On the contrary, merely by owning a

refining asset, it's not possible to reach market information. To conclude, the previous mean that acquisitions of storage tanks, terminals or refineries, are certainly not driven by desires to access exclusive or unpublished market information. The author of the thesis believes that, although there is some neutrality about this item expressed by Factor 1 and 2 arrays score (which is 0, while in Factor 3 array the item received a -3), had there been more participants related to the trading business involved in the research, this neutrality would change towards disagreement.

### *Disagreement with the items*

From the participants' points of view, it seems that spreading risks and overhead, and hedging against currency fluctuations, are not considered important reasons for investing in the European downstream oil sector. This is reflected also in the score this argument received in all Factor arrays (-3). According to the participant from Vesta Terminals, there is some truth in these reasons as for example, ownership of a terminal helps a trader to save part of the cost for storage including overhead, and so by acquiring a terminal you can spread some overhead costs. However, the participant in principle disagreed with the item, as in the big scheme if things, spreading risks, overheads, and hedging against currency fluctuations are not major drivers for investments in the European downstream oil sector. Other participants disagreed even more with these arguments. As the sector is going through hard times at the moment, it wouldn't be wise to make investments in it for risk-spreading. On the contrary, it is likely that as a firm you are undertaking more risk if you invest in the European downstream oil sector. Moreover, it is possible to hedge against currency fluctuations in the financial market, so there is no need to invest in a refinery in Europe for example for this reason. It is noteworthy that the participant from TU Delft emphasized that, currency fluctuations should not be perceived as a risk or a danger, as these are the reason arbitrage opportunities are created in the market, which in turn can be exploited mainly from traders. So, currency fluctuations are less of a risk and more of an instrument for profit creation.

An argument which received a lot of criticism from the participants holds that, asset-heavy strategies are becoming attractive because of the rise of financing and transaction costs due to regulatory changes in the banking and derivatives-trading environment. The argument received strong disagreement scores in all three Factors arrays (-4, -3, -5). First of all, these changes concern more the activity of speculators and for many big oil companies, like ExxonMobil for example, financing costs is not really an issue and it will not affect their decision making about investments in assets. Then it was commented by the participant related to Vesta Terminals that these changes have been affecting mostly the banking sector and eventually have "forced" banks to exit the business and sell their assets, which in turn has enabled many trading companies to buy these assets and to become more asset-heavy. However, the reason they acquired these assets is because they perceived good business opportunities in them and profit generation prospects, and not because their strategy is focusing on acquiring more physical assets due to the rise of financial and transaction costs as such. Furthermore, it is interesting to mention that despite of his slight disagreement with the argument discussed here, the participant related to Shell highlighted that terminal-heavy strategies may be indeed considered attractive, partially also because the capital required for terminals (and storage) is very low compared to refineries for example. Next to this, the participant related to BP made a general comment about this item, stressing that one of the issues the oil sector wants to solve, is that asset-backed transactions are not the same like the non-asset-backed, however they are often treated in the same way. This is something that should change, because asset-heavy strategies and asset-backed transactions entail significant costs, in the form of transaction costs, so they cannot be treated in the same way.

Accessing new skills and capabilities in specific businesses within the oil value chain, is not considered to be a major reason for acquiring assets in the European downstream oil sector, according to the opinions of many participants. This is reflected in the disagreement or neutrality scores this argument received in general (-3 in Factor array 1, -1 in Factor array 2 and -3 in Factor array 3). Most of the disagreement was expressed by the participants related to ExxonMobil, TU Delft and the CF, while the only participant who slightly agreed with the argument is the one related to Shell. Investing large amount of money, with the driver being to get access to new skills and capabilities, is not something easily observed in the market. However, it may happen in cases where there are companies, for example, new in the refining business, which want to enhance their expertise. For instance, it was stated by the participant from Vesta Terminals (who was more neutral about the argument), that some Chinese companies may be following this strategy and may be acquiring refineries in Europe for these reasons. After all, there is still a lot of knowledge in Europe, in terms of running terminals, refineries, and also trading, and it is not always that easy to find this knowledge, to buy it from the “shelf”. So there is always for a firm the option of hiring individuals with skills and expertise which the firm is missing, but sometimes this may not be enough and some acquisitions of assets may occur for accessing the lacking expertise. Nevertheless, these acquisitions will never be driven firstly by the desire of getting access to new skills and expertise; this will be a complementary reason.

Concerning the argument that effective tax rates (or otherwise stated; actual tax rates) on corporate profits in Europe, is an important driver for divestments in the European downstream oil sector, the participants on average disagreed with it. The argument received a -1 score in Factor 1 array, a -3 score in Factor 2 array and a -2 score in Factor 3 array. There are not a lot of comments made about the impact of tax rates on the investment strategy of firms involved in the downstream oil business in Europe, which indicates that participants do not consider it as something of great importance. As a matter of fact, other costs such as energy costs, feedstock costs and the cost of emissions are perceived as significantly more important reasons leading to divestments.

The issue of the increasing activity from independent retailers/distributors and hypermarkets, and whether this works as a driver for acquiring storage assets or converting refineries to storage in Europe, was also evaluated by the participants. The argument received a -2 score in both Factor 1 and 2 arrays, and a 0 score in Factor 3 array. In principle, there was either neutrality or disagreement with this argument expressed by the participants, not because there is no increased activity from the aforementioned players, but because this activity is not believed to constitute a major driver for storage acquisitions and conversions of refineries in Europe. The only thing that is changing is the bargaining power and the buying position of these stakeholders, but this is not influencing the investment strategies of other firms involved in the downstream oil business in Europe. According to the participant from Vesta Terminals, there is an example of a conversion decision which can be linked to the increased activity from retailers and hypermarkets -the Coryton refinery in UK- but no other similar examples are possible to be identified, hence this activity is not believed to be a major driver for conversions of refineries.

An argument which received some, not heavy, criticism by the participants, states that the joint ventures (JVs) many oil companies enter in, in the refining sector of non-European countries, actually help them to shut refinery capacity in Europe and supply their wholesale and retail networks in Europe with products from these countries. This argument was given a -1 score in both Factor 1 and 2 arrays, and a -3 score in Factor 3 array. First of all, strong disagreement was expressed by the participant from BP, concerning the need to have JVs in the downstream sector of countries outside of Europe in order to supply European retail networks with fuels. There is no compelling reason to do these JVs, because the

very liquid market in Europe, enabled by the liberalized infrastructure, ensures easy access to the fuels demanded. So there is no strong connection between entering in JVs outside the region in order to supply European retail networks with fuels and shutting down refining capacity in Europe. Other participants also agreed that there may be some truth in the argument discussed in this paragraph, however they do not perceive it as the keystone that refinery closures in Europe are based on. Nevertheless, the participants from FuelsEurope and Vesta Terminals expressed a slight agreement with the argument. They believe that these JVs in the downstream oil sector in non-European countries, will eventually lead to capacity closures in Europe, although it will not be easy to do so. For example, the JVs of Total in Saudi Arabia will enable the company to supply its European retail networks with products from that region, so it may eventually shut down more refining capacity in France for example. However, it is sure that the company will face tremendous pressures from labor unions or the government, so closures will not be an easy task. Nevertheless, it may happen and of course other companies may act similarly. This is a likely scenario because firms will keep evaluating their portfolio of refineries and more of them will decide to enter in JVs in markets outside of Europe, where there is more demand for fuels and the refining assets are more competitive (lower wages, environmental costs, more complex refineries). In such cases, firms will eventually re-structure their portfolios by shutting their small, non-complex European refineries and will start supplying the European markets with fuels produced outside of Europe.

The participants were asked to evaluate the argument that the higher freight costs for moving refined products to Europe from outside the region, than the costs for moving crude oil, is a major reason for investments in refineries located in Europe. In principle, there was disagreement expressed about this argument, concerning both the freight costs part of the argument and whether this is a major reason for investment in European refineries. The argument received a very low score in Factor 1 array (-4), and a relatively neutral score in both Factor 2 and 3 arrays (-1). The difference in freight costs is certainly not a major driver for investing in refineries in Europe, but it may offer some cushion against competition from outside the region, according to the participant from BP. Nevertheless, the people related to ExxonMobil and Vesta Terminals stressed that if it is cheaper to import products than to produce them locally in Europe, then imports will eventually increase. It is impossible to compete in the long run with the refineries outside the region which can produce fuels at a lower cost, so there is no major driver for investments in the European refining sector. A common statement by some other participants is that this argument was mostly true in the past but not anymore. The participant related to TU Delft also emphasized that freight costs are declining in general, while there is an overcapacity of ships which are also becoming more efficient and with better economies of scale. So this argument is not so valid nowadays. Moreover, in the past, the full oil barrel was converted into products, so the whole volume had to be transported. However, this is not the case anymore, where only part of the barrel is being used, most of it as feedstock. Nowadays there is a need to transport mainly large amounts of diesel, gasoline and kerosene. Next to these, increasingly large part of the barrel is being used by petrochemical plants, which are often integrated with refineries and therefore there is no need for transporting feedstocks from refineries to the petrochemicals plants.

#### 5.4.2 Disagreement among the participants' views

All of the aforementioned discussion concerned the items about which there was in principle consensus among the participants' opinions (on a statistical basis), whether that was agreement, disagreement or neutrality respecting the items. The second part of the discussion will focus on the more controversial items, the ones that largely revealed the different viewpoints of participants. The first step will be to

refer and discuss about the items which got a very different score in all 3 factor arrays, as they were presented in Table 6.

The item which aroused the most controversy among the participants, is No. 6, which states that changes in supply and demand patterns in Europe is a major reason for acquisitions of storage facilities or conversion of refining facilities to storage in the region, to help handle the new commodity flows. It is interesting to notice that this argument received a +5 score in Factor 2 array, a +2 score in Factor 1, and a -2 in Factor 3 array. Indeed, some participants loading significant only on Factor 2, such as the ones related to COVA, Shell and the CF, strongly agreed with this argument. They believe that since the gasoline demand pattern has changed and the demand for diesel has risen, there is an increased need to import and export products and hence, an increased need to have storage facilities to handle the bog cargoes. Moreover, one of the relatively easy ways to get more storage assets is by converting refineries. In any case you need to have these storage assets in Europe and use them as a hub. Nevertheless, the participant from the CF stressed that conversion of refineries is seemingly an easy way to “create” storage capacity, but the truth is that it is not as easy as it is perceived. A good example of these difficulties to convert a refinery to storage, is the Coryton refinery in UK, where the people of Greenergy have often been emphasizing the technical obstacles they are facing. The participant related to Vesta Terminals (who also loaded significantly on Factor 2 but also on Factor 1 to a lesser extent), also agreed with the argument. He emphasized that while these new commodity flows represent a threat for the European refining sector, as the new exporting refineries especially in Asia are adding a lot of pressure, they represent at the same time a big business opportunity for terminal companies. This also means that indeed the need to handle the new product flows may a serious reason to convert, despite of the disadvantages converted terminals have to real terminals, as the former have to change their jetties and other infrastructure, their location may not be the ideal to be used as import hubs (former refineries were usually built where the demand was) etc. On the other hand, the participants related to the Ministry of Ec. Affairs and the one from the EC (who loaded significantly on Factor 3), disagreed with this item. According to the latter, the fact that the level of demand is going down in Europe does not provide, in general, incentives to invest in refineries and storage in the region. The investments that are made by some Chinese and Indian firms in the European downstream oil sector are also, probably, not driven by the changes in demand and supply patterns in Europe, where the future expectations for demand and growth rates are bleak.

Another controversial item was the one that considers that the fact that European refineries cannot compete with their counterparts in Asia and the Middle East, as the latter are of high complexity and scale, works mostly as a driver for upgrading and expansion investments in European refineries (Item No. 25). Factor 1 gave a high score on this item (+4), while Factor 2 gave it a negative score (-2) and Factor 3 gave it a neutral score (0). In terms of the competition the European refining sector is facing from Asia and the Middle East, all participants agreed that the former cannot compete since the new capacity in Eastern of Europe is indeed modern, of a large-scale and of high complexity. Some of the participants who are also loading significantly on Factor 1, such as the ones related to FuelsEurope and ExxonMobil, indeed agreed that this competition is a major reason to invest in (upgrading) some refineries in Europe, in order to make them competitive again. The competition is not going to decrease and if a refining site wants to survive, it has to take actions, it has to invest. However, investments will happen only if there is a good opportunity and only in refineries which are considered to belong to the “survivals”. Small, simple refineries, positioned in disadvantaged locations will not attract investments because of the competition they face from Asia and the Middle East. On the other hand, there were several participants (related to the EC, the CF, to Vesta Terminals and to the CIEP) considering this form

of competition as a driver for divestments, highlighting at the same time that the investment decision of ExxonMobil for its Antwerp refinery, is the exception that proves the rule. In general participants who think competition from Asia and the Middle East works as a driver for divestments, all agreed that the competitiveness gap between refineries in Europe and their counterparts in the East is simply too big to make investments in the former in order to compete with the latter. Again there may be exceptions when refineries are very-well located, for instance in the Rotterdam and Antwerp region, or are very sophisticated like the Pernis refinery in Rotterdam, which eventually may attract upgrading investments and will manage to survive the competition. However, in principle most of the other European refineries will not attract similar investments just to compete with their counterparts in Asia and the Middle East and thus, many of them will be in the black list of candidates for divestments.

Different viewpoints of participants were revealed also when they were asked to evaluate the argument that the need to comply with the European environmental legislation (including biofuels mandates), works mostly as an incentive for upgrading investments in refineries. Strong disagreement with this item was expressed by some participants who loaded on Factor 1, which resulted in a -5 score in Factor 1 array for this item. However, the item was given a +1 in Factor 2 array and a +3 in Factor 3 array, which highlights the disagreement among participants' opinions. Before revealing some individual viewpoints of participants, it should be mentioned that many of them emphasized the fact that the use of the word "incentive" is maybe not the most suitable in this case, as the need to comply with environmental legislation is more an obligation. So the legislative burden does not provide incentives for upgrading but it "forces" firms to invest if they want to remain in the business. Therefore it indeed leads to some investments but in the way the word "incentive" implies. Some of the participants that really disagreed with this statement are related to BP, FuelsEurope, the Ministry of Ec. Affairs and Vesta Terminals. They all agree that the environmental legislation works rather as a driver for divestments, than for investments, of refining assets in Europe. The participant related to the Ministry of Ec. Affairs emphasized about biofuels, that their penetration takes place at the end of the production and supply chain, and there is no connection between decision making about investments in refineries and biofuels penetration in the fuel mix. The expected margins are determining investments in refineries, and the addition of biofuels into the fuels does not provide investment incentives. The participant related to FuelsEurope stressed that the biofuels penetration combined with the general fall of demand for oil products, means conventional refiners' business is eroded and in this case, incentives appear for reducing capacity or closing and not for upgrading. Furthermore, as a fossil fuels producer, we observe that biofuels and fossil fuels are not on a level-playing field; biofuels are present because of mandates and so this makes their cost-effectiveness assessment very difficult. The participant from BP also mentioned that the environmental legislation works more as an incentive to divest asset, because even if a firm is investing to stay in the business, there comes a point where further incremental investments cannot be justified for compliance reasons. However, the environmental legislation never works alone, as one factor. It's a combination of other factors as well, like the price on carbon, the energy costs, labor and taxation issues, which altogether with the environmental regulations are creating drivers for investments or divestments in the refining business in Europe. Moreover, energy costs are probably the most important of all of these factors, for determining the current state of the refining sector in Europe. On the contrary with the previous participants, there were some who agreed to a limited extent with the argument, like the participants related to Q8, Hestya and Shell. Their agreement is believed by the author of the thesis, to be based on their beliefs that indeed, the need to comply with environmental legislations leads to investments. However, yet again they emphasized that there is no real incentive provided, rather the need to stay in the business is what drives these investments. Compliance with legislation requires increasingly amounts of capital and it becomes further and further difficult to keep

investing. Moreover, as the participant related to Shell explained, refiners always need to keep investing for ensuring the asset integrity of their plants (maintenance, replacing units reaching the end of their lifetime etc.), and for complying with regulations -staying in the business. These activities quite often consume all of the available capital and then there is nothing left to be invested in growing their business. So, this issue of the non-profitable capital invested is a very serious problem for many European refiners, who due to the increasing environmental legislations are trying to keep their plants in shape but are losing on profitability, because they cannot make investments which will generate profits.

The argument that conversions of unprofitable European refineries to terminals are largely driven by reasons of reducing the plant's costs and of releasing working capital, was refuted by some participants, supported by fewer and received a more neutral score from many others. Item 32 received a -4 score in Factor 1 array, and a +2 score in both Factor 2 and 3 arrays. The participant related to FuelsEurope strongly disagreed with this argument, because as he explained, reducing costs and releasing working capital are factors which are facilitating divestments or conversions but they are not the main drivers behind them. The main driver is that the refining business is not generating profits and is not expected to do so in the years to come. So the working capital which is released by divestments, is not "saved" but it is displaced somewhere else, where there are better profit prospects for the future, maybe outside of Europe. On the contrary, the participants from the Ministry of Ec. Affairs, the CF and the EC agreed with the argument. According to the latter's viewpoint, if a refinery is unprofitable, shutting it down and then starting it up again entails significant amount of costs required. If these costs cannot be met, given also the very low refining margins nowadays, an unprofitable refinery will find more and more difficult to shut down and restart later on, so the option to convert it starts becoming more attractive. Other participants were a bit more neutral about the argument. The one related to Shell mentioned that he do not exactly agree with the statement, because reduction of a refinery's costs suggests that the plant keeps running at a lower level. However, this is not the best thing to be done in a refinery, because the plants should keep running above a certain level, in order to keep the costs low on a barrel basis. So the true options are either to keep the refinery running on a higher level or to close it down completely and convert it. So there is some truth in the argument. Last but not least, the participant from Vesta Terminals highlighted his agreement with the argument, especially with the respect to the working capital considerations, however he emphasized his disagreement about the true reasons for shutting down an unprofitable refinery and converting it; the real reason is that the plant is not generating profits and that there is a need to reduce costs as such. If this wouldn't be the case and the plant would be performing well, there would be no motivation at all to release working capital out from the refinery.

Another item which was ranked very differently by the participants is item 5, which states that the high taxes on emissions in Europe is a major driver for divestments of refining assets. This argument was given a +3 score in Factor 1 array, and a 0 and a -4 score in Factor 2 and 3 arrays respectively. It is interesting that there were participants who strongly agreed and disagreed with this argument. For example, the participants from the CIEP, BP, Vesta Terminals and Hestya (all loaded significantly on Factors 1 and 2) expressed their strong agreement, while the participants related to Shell, the EC and Q8 (all loaded significantly on Factors 2 and 3) strongly disagreed. To start with the agreement comments, participants from both the CIEP and Vesta Terminals expressed their concerns about the burden of the taxes on emissions in Europe and they indeed consider this as a major driver for divestments of refining assets. They believe that emissions taxation is something which is creating a lot of problems and hazards for extra investments in Europe. On top of that, the fact that the rest of the world is not following with similar policies makes the situations in Europe even worse. The taxes on

emissions, is part of a bigger problem, namely the uncertainty about the direction of regulations in Europe, and all of this uncertainty creates drivers for divestments of refining assets. The participant from BP also agreed that emissions taxation works as a driver for divestments but he also added some important remarks. First of all he emphasized a better wording would refer to price on emissions, rather than to taxes on emissions. So, the price on emissions, whether this is induced by taxation or by emissions trading, is a major driver for divestments of refining assets in Europe, because there are provisions to avoid carbon leakage but only to a certain extent. Next to this, these measures to protect European CO<sub>2</sub>-intensive industries, such as refineries, are being eroded by the cross-sectoral correction factor which simply makes the cost of business higher in Europe than for outside the region. Then he continued by mentioning that it is incorrect to say that the price on CO<sub>2</sub> is nowadays so low (compared to the price in 2008 which was very much higher), that it is not affecting the business. For an industry which is already in the verge of disappearing, even a minor extra cost due to carbon prices plays a role. Considering also that the cost for transporting crude and products is very low, it is not difficult to understand the advantage of export refineries outside of Europe, which can produce fuels at a 0 €/ton carbon cost. Additionally, he also emphasized is that on top of all the previous come the expectations about the future prices on CO<sub>2</sub> emissions, which are expected to increase due to the design of the Emissions Trading Scheme (ETS) with the cross-sectoral correction factor and maybe due to some political intervention in the ETS. The anticipation of higher costs for emissions, combined with all the other factors affecting the European refining sector, do not make easy investment decisions and on the contrary are a driver for divestments. Nevertheless, the participant related to Shell strongly disagreed with the argument under discussion in this paragraph. He believes that most of the effect of the emissions taxation on the sector has already taken place and maybe refineries in Eastern Europe will keep being affected for some more time. The taxes on emissions are not believed however to be driving the divestments observed in the European refining sector. The real causes are the overcapacity and the poor margins. The emissions taxation is just instead “making a selection” of refineries, helps decide which of them will survive and which are the weakest that will be divested. Last but not least, the participant from the EC does not perceive the taxes on emissions or the ETS as a problem at all. He stressed that the industry side is quite satisfied that no reforms of the ETS are to be expected until 2021, and he believes that the ETS is far from being a relevant element in investment-making decisions at the moment or in the near future. Of course, the importance of the ETS for the industry is acknowledged, as well as that the extra cost that it brings for Europe refineries may be an issue, however, it is not believed to be a highly relevant issue when it comes to decide upon investments or divestments of assets.

When it comes to financial considerations and if for example weak corporate balance sheets and difficulties to access credit, work as a major barrier for investments in the European refining sector, the participants also indicated towards different directions. Consequently, the argument was slightly supported by Factor 1 (+1), was slightly not supported by Factor 2 (-2) and was strongly supported by Factor 3 (+5). The participants who disagreed most were the ones related to Vesta Terminals and COVA, while the ones related to ExxonMobil and Shell also disagreed but to a lesser extent. On the contrary, the participants from the EC, the CIEP, Q8 and TU Delft strongly agreed with the argument. To start with the disagreement, both the participants from COVA and Vesta Terminals do not believe that firms involved in the European refining business have difficulties to access credit or have weak net sales. Of course, there is always the exception of Petroplus and other independent refiners may be facing such difficulties, but in principle firms involved in the business do not have this type of financial problems. Therefore, there is no such thing as non-access to credit and weak balance sheets, as major barriers for investments in the European refining sector. A true barrier may be that firms can invest their credit

elsewhere in a more profitable way, but not that they cannot access it. Some of the participants who slightly disagreed with this argument, also made some interesting comments, like for example the one from ExxonMobil who stressed that whether this argument is right or wrong varies from company to company. He emphasized that there are some companies, like the independent refiners which have weak balance sheets and are facing many more difficulties to invest than other firms in the business. Particularly the independents which are highly leveraged (like the case of Petroplus) are the most vulnerable to market downturns. When these downturns happen, banks are turning against them and this in turn puts these companies under enormous pressure because they cannot access credit easily, and thus the likelihood of them becoming insolvent increases. Nevertheless, when the whole sector is considered, there are a number of financially sound refiners in Europe, so overall for the refining industry there are still possibilities to make investments. The participant from Shell mentioned that accessing credit is not the key issue. It is rather the issue that an investment in order to be done, has to bring back a proper return. If a refinery is making losses it will never earn the profits to be invested. So the question then is; should the refiner invest a large amount of capital to make the plant more profitable, with the hope to regain the invested capital? Can a refiner “invest himself out of trouble”? This is a very difficult question to be answered and this is what may hinder investment decisions, as often the answer to this question is no. Contrary to the participants who in general disagreed with this argument, the participant from the EC believes it is true, and there is no better example of this than the case of Petroplus. The growing number of divestments in the European refining sector by the large vertically integrated oil companies, along with the increasing number of new entrants, which are small players with less financial means, is going to increase the danger for more “Petroplus cases”. Difficulties to access credit and weak balance sheets are very relevant to the situation in the market today, and constitute a major barrier for investments.

One of the items which is not focusing on refineries, is item 21 which states that acquisition of midstream fixed logistic assets leads to better and faster exploitation of arbitrage opportunities. This argument received a very high score in Factor 2 array (+4), but a slightly low in both Factor 1 and 3 arrays (-1). Participants who strongly agreed with this argument are related to Shell, Vesta Terminals, the CIEP and the CF, whereas strong disagreement was expressed by the participant from FuelsEurope. The disagreement of this participant is explained by the way he perceived this argument; from the standpoint of a refiner. However, focusing on midstream assets and on exploitation of arbitrage opportunities is the business of a trader, and a refiner would not normally undertake many of the activities of a trader. Hence, a refiner would normally not be interested in acquisitions of logistics assets, in order to exploit arbitrage opportunities. When it comes to agreement with the argument, the participants from the CF and Shell made explicit that you need to have midstream logistic assets, to allow you to make use of arbitrage. The latter stressed that the key issue for many firms in the business in Europe, is to be able to “ride the waves” of an extremely volatile market characterized with overcapacity, in the most efficient way. Acquiring midstream fixed logistic assets provides therefore the means to a firm to perform its operations more efficiently. The participant from the CIEP identified similar reasons when he explained his agreement with the argument; the market is very volatile, and the more volatile it gets the more flexible strategy a firm needs to have. The way to enhance its flexibility is by acquiring midstream fixed logistics assets. Last but not least, the participant from Vesta Terminals highlighted that possessing midstream fixed logistics assets helps you to take advantage not only of arbitrage opportunities, but of trading opportunities as well. To do achieve that, does not require necessarily ownership of midstream logistics assets, as there is always the option to rent such facilities. However, in the long-run the trade-enhancing nature of having access to assets should lead a firm to their acquisitions. Furthermore, many firms want to possess midstream assets because in this

way, they can also take advantage of any contango situations in the market. Contango does not happen so often, but when it happens a firm can generate serious if it possess its own storage assets and it doesn't have to rent them. Additionally, owning midstream logistics assets enables a trading firm to design them based on its own requirements, thus this makes it advantageous to possess the asset than having it rented. For refining firms this argument is not so applicable, but it depends on the case. For example some Russian refiners which are running their plants on Urals crude, may find it beneficial to own some midstream fixed logistics assets for arbitrage exploitation purposes.

One of the arguments with which almost all participants agreed with, was stating that retaining sufficient refining capacity in Europe is a key factor for the region's energy security. This argument received a +5 score in Factor 1 array, a +2 score in Factor 2 array and finally, a 0 score in Factor 3 array. Many participants who loaded significantly on Factors 1 and 2 (related to TU Delft, COVA, FuelsEurope, ExxonMobil, Ministry of Ec. Affairs) strongly agreed with the argument and emphasized the need to retain some refining capacity in Europe for both security and dependency reasons. Being completely dependent on imports means that full vulnerability to the market volatility and that potentially higher supply costs. The latter is because without refineries it's not possible to create some security of supply by holding part of stocks in crude and holding your stocks only in refined products form is more costly. Moreover, having no refining capacity practically means that there is no flexibility in changing the slate of products offered to the market and this in turn also reduces the ability of (European) governments to intervene in the production and allocation of fuels among areas, countries or different groups of users. However, participants from TU Delft, the CIEP and Vesta Terminals recognized that the previous considerations do not mean that Europe has to be fully able to supply all of its oil products from its own refineries. Maintaining a right balance between imports or refined products and an economically viable refining sector is the most important issue, and not keeping a surplus of capacity in Europe solely for strategic and security of supply considerations. There participant related to the CIEP believes as well that having to import more refined products than in the past it's not a major problem, considering the global oil products market nowadays, even if the volatility is higher in the products than in the crude oil market. Increased imports would a more serious issue in the case of natural gas for example, but not so much in the case of oil and refined products. Another interesting comment made by the participants from the CF and the EC, is that the issue of retaining sufficient capacity for security reasons is and should be, an important issue for European governments, politicians and the European Commission. However, it seems that in terms of actions none of them is viewing it so seriously, as more refineries are closing.

One of the arguments which received considerable criticism from many participants is item 24, which considers local opposition as a major barrier for expanding or upgrading refining facilities in Europe. This argument received a 0 score in Factor 1 array, a -3 score in Factor 2 array and a -5 score in Factor 3 array, so obviously it was not supported by the participants in general. However, there were a few exceptions of participants who supported this argument. So for example the participant related to TU Delft mentioned that he considers local oppositions indeed as a barrier for upgrading or expanding refining facilities in Europe, but this is more a general tendency. Not only refineries but also other industrial plants in other industries are facing similar issues with local opposition, which in the end affects planning of investments, costs and adds more difficulties. Moreover, refineries which are often located close to sea deep-water ports are more vulnerable to this opposition. The participant from Vesta Terminals also considers the argument as being correct, but only to a certain extent, as he believes that local opposition is much more present in cases of new refineries constructions. So the local opposition which arises when upgrading or expansion of a refinery takes place, may indeed create

problems, but in the end the investments will be done. However, building a greenfield refinery, is something not likely to happen in Europe nowadays. The participant related to BP emphasized his agreement with the argument, by providing the example of the Gelsenkirchen refinery in Germany, which is a 50-50 JV between BP and Rosneft. There were plans to expand this refinery, not in terms of capacity but in terms of adding petrochemicals units, but these plans aroused huge public opposition, for environmental reasons, for noise issues etc. What is more interesting is that this refinery is located in a region with high unemployment rates and maybe an extra reason for the opposition was that many residents of the region are unemployed by the refinery. However their main arguments were that the refinery would be coming closer to residential areas and that it would be affecting negatively the local environment and local peoples' everyday lives more and more. On the contrary to the previous participants, there were several others who strongly disagreed with the argument, like the ones related to Q8, Shell, the CIEP, the EC and ExxonMobil. The first one of these participants mentioned that she had never experienced strong local opposition about issues concerning the refinery of the company in Rotterdam. Especially in the Netherlands and in Rotterdam, there is a general climate which allows for investments in refineries, and as long as a plant meets the environmental criteria, it is unlikely to see local opposition against investment plans. The participant related to Shell believes that local opposition is something which was happening mainly in the past and that nowadays it is not a serious issue. There may always be some stakeholders, particularly environmental groups, trying to block expansions or upgrading investments in refineries, but in most of the cases they do not create a major barrier for these investments to take place. What counts in general is to show as a company, the necessary respect to all the stakeholders involved and then it is often the case that you can reach an agreement with many of the opposing players. In the end, local communities can also benefit from employment creation, so if a company wanting to invest, shows the necessary respect to the local people, it will not face serious problems due to local opposition. The job creation argument was also emphasized by the participant from the CIEP, who believes that the work security and jobs provided by the refineries, especially in Antwerp and Rotterdam regions, is a factor which does not allow for creation of local opposition against investments in refineries. It is true that there is an environmental impact from refineries in these regions, but the economic benefits far outweigh the disadvantages, so the scenario of having local opposition against refineries is unlikely. Additionally, the participant mentioned that the biggest issues in terms of barriers for investments due to opposition can be identified in the upstream and not in the downstream operations, so he strongly disagreed that there are these kinds of barriers for investments in the European refining sector. Last but not least, the participant from the EC stressed that the main barrier he sees from local opposition, is for closing a refinery and not for investing in a plant. Potentially of course, local opposition could become a barrier for investments but at the moment in Europe, local communities are more concerned with keeping refineries open, especially in fairly low populated areas where the plants are important for employment purposes. This is much truer considering that many refining sites were populated after the plants were built there. So conclusively, it is unlikely that a firm would have to face local opposition if it would announce its intention to expand or upgrade a refinery in Europe.

An argument which was perceived quite differently from the participants, argues that the growing competition European refiners face from their US counterparts worldwide, works mostly as an incentive for upgrading and expansion investments in European refineries. This argument was positioned under +2 in Factor 1 array, and under -4 in both Factor 2 and 3 arrays. It is interesting to mention that only two participants slightly agreed with this argument, namely the ones related to FuelsEurope and the Ministry of Ec. Affairs. The latter justified his agreement by referring to the general need there is to invest in European refineries, in order to change the mix of production and increase the

share of middle distillates, alongside with decreasing the share of gasoline. Nevertheless, most of the participants disagreed with this argument. So participants related to BP, COVA, ExxonMobil, Q8, Vesta Terminals, the EC and the CIEP, all believe that the competition European refiners face from the US, works mostly as a driver for divestments and in any case, certainly not for investments. Participants related to the EC, Vesta Terminals and ExxonMobil acknowledge however that there may be cases where, this type of competition might indeed work as an incentive for European refiners to upgrade. This will occur only in cases where investments will truly enable a refinery to survive or outperform the competition from abroad, and this means that only some well-located and perhaps complex-enough refineries may attract those investments. Such is the case for example of the ExxonMobil refinery in Antwerp, where the company perceives that it is a “winner-refinery” which can serve markets beyond European borders, and therefore it decided to invest in upgrading it. On the other hand, poorly performing assets will definitely not attract similar investments and may be divested. The participant from the CIEP emphasized that it will not be possible for European refiners to compete with their US counterparts in the next years, even if they will manage to upgrade their plants. The reason is that their competitors in the other side of the Atlantic are greatly benefiting from the shale revolution, which offers them lower feedstocks and lower operating costs, in terms of gas supply. Because of this reason, US refiners have been improving their efficiency and they will keep improving it as, according to the participant’s opinion, the shale revolution will not be a temporary issue. On the contrary, it will bring structural long-term changes in the market, and the more US companies use and evolve the shale technologies, the more knowledgeable about it they become and subsequently, they will keep increasing their efficiency and competitive advantage against European refiners. All of these considerations make clear that the competition from the US works as an incentive for divestments, rather than for investments in refineries in Europe. The participant from BP also made several interesting comments about the issue at stake. First of all, he admitted that the US market has traditionally been one of the markets for gasoline produced in Europe, but given that nowadays the demand for gasoline in the US has decreased significantly, it could be argued that this would incentivize European refiners to invest in conversion capacity and start producing more middle distillates to meet demand for fuels in Europe. However, the dynamics do not work in this way. One of the reasons the US competition does not provide incentives for upgrading investments in European refineries, is the increasing competition the latter face from Russia, Middle East and Asia. These competitors East of Europe, are able through their complex and large-scale refining capacity to provide the European market with the middle distillates it demands, leaving no market for European refiners to claim. European refineries are “squeezed in the middle” by all competitors. In the US, given the ban on exports of crude oil and the prices the WTI crude is traded compared to Brent, refiners enjoy low costs for energy and feedstock, in Asia there are lower labor costs and larger and more complex refineries, while finally in Europe there is overcapacity with many non-complex refineries and high energy and labor costs. The combination of all of these factors has not offered incentives to the companies involved in the refining business in Europe to invest more in upgrading their plants and this is not likely to change in the near future. Conclusively, the competition the European refining sector faces from the US, works as an incentive for anything but investments.

### 5.4.3 Other items

Now both the consensus and disagreement items have been presented and discussed. What follows in the next paragraphs is a discussion about all other items which were not touched upon yet. It is noteworthy that almost all items were either given one of the extreme scores (+5, +4, -4, -5) in at least

one Factor array or they were identified by the PQMethod software as distinguishing items for at least one of the 3 Factors. The only two items which did not fit in any of these two categories are items 14 and 38, but they will also be discussed. The following discussion about all the items will help to further reveal the diversity among participants' points of view or highlight other areas of consensus between them. This will eventually offer a better overview of what is perceived by all stakeholders as important or not important, for realizing investments or divestments in the European downstream oil sector.

The first argument to be discussed states that the mature European downstream market makes attractive the option to divest downstream assets in Europe and refocus on a strong downstream presence in other growth markets. In general participants agreed with this argument, something reflected in the scores it received in all 3 Factor arrays (+4 in Factor array 1, +1 in Factor array 2, +3 in Factor array 3). The participants related to TU Delft, BP, COVA, FuelsEurope, the EC and the CIEP strongly agreed with this argument. Some of them emphasized that this is a very important driver particularly for the IOCs, because these firms want to stay in the refining business but not in Europe, which is a mature market with low or negative growth rates projected for the future. So many IOCs have been allocating their capital with a focus on other growth markets (especially in Asia) and hence, they have been increasing their downstream presence there. The participant from BP, although he strongly agreed with the argument, revealed a different viewpoint as he believes that the mature European market does not make attractive the option to divest assets, but it makes it more a necessity. Because of the situation in the market in Europe, divestments are required and of course the released capital can then be directed towards the downstream sector of other growth markets. The participant related to Vesta Terminals also agreed with the argument to some extent, and he highlighted that trading companies are also following the strategy of investing more in the downstream sector of countries where there is market growth and margins are better. It is interesting to mention that there was also slight disagreement with the argument by some participants. For example, the participant from the CF does not agree so much with the argument, not because there is not any good rationale in it, but because he believes that the general trend nowadays in the market, is to divest downstream assets not only in Europe but everywhere in the world. So it is not easy to see a lot of examples of firms proceeding with divestments downstream in Europe, in order to invest more in the downstream sector in other regions of the world. The participant related to Shell also disagreed (slightly) with the argument and commented that there is an important distinction that need to be made between the firms involved in the downstream business in Europe and for example in Asia. Whereas in the former case there are still many IOCs involved in the downstream business, in the latter the majority of firms involved are NOCs. The vast amount of investments in new refineries in Asia are being made by these NOCs and for the IOCs, it is much more difficult to decide upon similar huge investments in that region because the economics of the market there are different than in Europe. IOCs are less optimistic about the prospects for future growth in Asia than the NOCs located there and additionally, the latter have a different way of decision making about investments. So for example, while an IOC would be concerned only with the financial considerations (NPV, IRR studies etc.) of a new investment in the downstream sector of an Asian country, a NOC of that country would make its decision based on both financial and other political or strategic considerations. So by being more critical about the future growth predictions for Asia and by having a different rationale in their decision making, IOCs are much more reluctant to invest in the downstream business there. Moreover, even though many studies have been overoptimistic about the market growth rates in the East, it is possible to observe now that capacity in Asia is increasing faster than demand, so the whole region is moving in a huge overcapacity position. Conclusively, investing in the downstream oil sector in growth markets in Asia for example is not the

easiest strategy to follow and probably not the most appropriate one, for the IOCs which are divesting downstream assets in Europe.

An argument which gathered a lot of criticism by almost all participants states that a major reason for acquiring storage facilities or converting refineries to storage in Europe, is compliance with compulsory stock obligations (CSOs). This argument received disagreement scores in all 3 Factor arrays (-5, -2, -1 respectively) and it was particularly criticized by participants related to FuelsEurope, ExxonMobil, Shell, Hestya and Vesta Terminals. The participant from FuelsEurope does not believe that CSOs is a factor driving conversions of refineries to storage. On the contrary, of more importance is if the refinery is profitable or not, now and in the years to come. The main driver for converting a plant would be its performance and the CSOs is something that exists and it is taken into account but is not driving conversions. The participant related to ExxonMobil emphasized that CSOs are certainly not driving storage assets acquisitions or refineries conversions, because indeed CSOs have to be met but it is not necessary to invest a lot of money to achieve this. Investing just for meeting the CSOs does not seem a rational strategy, considering as well that CSOs may not be present forever or that the obligations may change. The participant from Vesta Terminals agreed that CSOs have led to investments in storage facilities, but this dynamic is rather stable at the moment, so he does not perceive this factor as a major driver for further future investments in storage assets. Moreover, conversions of refineries to storage with the purpose to use them for strategic stocks, is mostly an act of desperation than a strategy, because it is likely that many of these refineries were cheap, low-value plants which could not attract any buyer or be used for any other business, so they are used for CSOs. Therefore, compliance with CSOs is certainly not the major driver for acquiring storage assets or converting unprofitable refineries to storage. The participant from Hestya also agreed with part of the reasoning of the participant from Vesta Terminals, as he identified that there are refineries in Europe which shut down because they could not stay in the business. Subsequently, because these refineries have tanks on site, some of them where used for meeting CSOs. So CSOs are not intensifying conversions of refineries, but it mostly works the other way around; the plants are shutting down and then they are just used for keeping strategic stocks.

An argument which was in principle supported by participants, considers that the fall of demand for gasoline in the US market is a significant driver for divestments in the European downstream oil sector. The argument was given a high score in Factor 2 array (+5) and Factor 3 array (+3), and a lower score in Factor 3 array (+1), however all scores are positive which highlights the general agreement with it. This argument received particularly high scores by participants related to BP, COVA, Q8, Shell and the CF. The first one of these participants mentioned that the falling demand for gasoline in the US market is translated to a shrinking business for European refiners. When a refinery in Europe is losing its gasoline market, certainly the last thing it wishes to do is to invest in any form. However, it has to reduce the share of gasoline from the crude oil barrel it processes, and of course a way to do that is by investing in more conversion capacity, also in order to increase the production of middle distillates demanded by the European market. The latter is not always an easy task, because there are certain physical, fiscal and economic limits to that, and especially in Europe, refineries cannot easily invest in conversion capacity because of the bad investment climate. Even if a refinery could realize such an upgrading investment, it would be difficult to make it profitable considering that large volumes of middle distillates produced in the Middle East and Asia, are already penetrating the European market. Furthermore, the European refining sector is suffering from refining overcapacity and other environmental factors such as high energy costs and environmental legislation. The overcapacity issue itself, emphasized by both participants related to BP and Shell, is a structural problem and it simply

means that more refineries closures will have to follow and the industry will have to consolidate itself. The other external environment factors are actually worsening the situation and are adding more burden on European refineries, which are already in a difficult position due to the overcapacity. In the end, the combination of the overcapacity in the region, the high energy costs, the high costs for compliance with environmental legislation, the competitive pressure from refineries East of Europe in the middle distillates market and finally, the shrinking gasoline market in the US market, are all leading to inevitable future asset divestments in the European downstream oil sector. The participant from the CF also emphasized that it is a combination of factors affecting the European refineries' business which has led to low margins, and the fact that gasoline demand in the US market is decreasing, is further pushing down the margins. Next to this, the participants from the CF and Vesta Terminals added that European refineries are losing gasoline market share not only in the US, but also in other global markets like Africa and Latin America, where the US refineries are gaining ground. In the end, European refiners are left with a gasoline surplus without any market so sell it, so there are under a lot of pressure and divestments of assets are inevitable. The participant from Q8 emphasized that the only way for gasoline-heavy refineries in Europe to survive the loss of their gasoline market share, is to invest in conversion capacity and the ones that will not do this, will be eventually either closed down, sold or converted into terminals. Finally, both participants from COVA and Hestya agreed the reduction of gasoline demand in the US is explained by the fact that US refiners are nowadays capable to supply their own market, so they have taken over the business of European refineries. Therefore the later have seen their profitability being severely hit and hence, divestments seem to be the preferred option for many refiners in Europe.

Another argument which was perceived positively by almost all participants (with only one exception where one participant gave it a -1 score), states that the higher volatility and lower returns from investments downstream, than the ones from investments upstream (crude oil production), are a major driver for divestments of downstream assets in Europe. The argument was given a +4 in Factor 2 array, a +3 score in Factor 1 array and a +1 score in Factor 3 array. Participants related to COVA, Hestya, Vesta Terminals strongly agreed with this argument and they emphasized that this is the very reality in the market nowadays, especially for the major oil companies like Shell, BP etc. It is true that upstream is more profitable than downstream and this is something expected to remain in the future as well, thus many oil companies which have strong E&P prefer to divest downstream assets and focus more on their upstream operations. The participant from the CF also strongly agreed with the statement and at the same time he mentioned that it is remarkable that the major oil companies are divesting downstream assets worldwide and not only in Europe. So the fact that these firms are selling downstream assets in South America or Africa is quite noteworthy, considering that these are growth markets. Hence, divestments of downstream assets are a global trend and it seems that indeed, one of the most important drivers behind them is the willingness to focus on investing more in the upstream business. Last but not least, the participant from FuelsEurope also agreed with the argument but not so strongly. He indeed believes that investments in E&P are necessary especially for the major oil companies, as this is actually the starting point of the whole oil value chain and you need, as a company, to have production in order to have downstream business as well. Next to this, these type of major oil companies need to have strong production for one more reason; for being able to attract investors. Therefore, it makes sense for them to divest some downstream assets (but they always need to maintain some refining capacity for their crude production) and increasingly spend more for their upstream business. However, firms involved actively in E&P are having a specific business model, which does not allow them to run certain downstream assets in a profitable way and therefore, they are considering divestments. There do exist however, other non-integrated firms like independent refiners

or specialists in petrochemicals, which have less financial capabilities compared to the oil majors, but are capable of managing downstream assets differently, in a more profitable way. This is because they have different business models and then maybe they can run a refinery which a major oil company could not. So the business model of the big oil companies makes a big difference in their decisions to divest downstream assets that they cannot operate in a profitable way, in order to release capital for investments in their upstream operations.

When it comes to the competition European refiners face from their Russian counterparts in the European market, participants were asked to give their opinion on whether this competition works mostly as an incentive for upgrading investments in European refineries. The argument received mostly negative scores, with only a few exceptions of participants attaching a neutral or slightly positive value to it. Hence, Factor 1 slightly disagrees with the argument (-2), Factor 2 strongly disagrees (-5) and Factor 3 slightly agrees (+1). There are not a lot of comments by the participants about this argument, but the people related to BP, COVA and the CF all strongly disagreed and explained the reasons why. The latter one considers that there is no direct correlation between the competition from Russia and the investment or divestment trends in the European refining sector. Russian refineries have traditionally been exporting gasoil and diesel in Europe and even if they will increase their diesel exports, this is not probably going to have a huge impact on the European refining sector. The participants related to COVA and BP expressed their disagreement with the argument, for a different reason; they believe that competition from Russia works more as an incentive for divestments and not for investments in the European refining sector. This form of competition is gaining more ground in the European middle distillates market, and combined with the shrinking gasoline demand in the US market and all the other external factors (energy costs, environmental legislation etc.), creates a situation in Europe which massively discourages investments in refineries.

An argument which arose much disagreement from participants is the one that considers that a major driver for acquiring downstream assets in Europe, is because it is a good way to help to serve the growing demand for fuels in Asian countries. This argument received negative scores in all 3 Factor arrays (-3 in Factor array 1 and 3, -5 in Factor array 2). Participants related to COVA, BP, ExxonMobil, the Ministry of Ec. Affairs, Hestya, Shell, Vesta Terminals, the CF and the CIEP, all strongly disagreed with the argument. Some of them identified that producing fuels in Europe for supplying Asia was something which was happening in the past but not anymore. Nowadays, if a company wants to serve the Asian market it will invest in Asia or the Middle East, but certainly not in Europe. Furthermore, there are many newly built refineries in Asia (so many that the region is moving to an overcapacity situation), which are in a much better position to serve the local market, so acquiring a refinery in Europe to compete with them is a very bad strategy. As a matter of fact, none of the European refineries which can be acquired cheaply can compete with their Asian counterparts in serving Asian markets. This may not be possible even for the highly sophisticated refineries in Europe (usually not for sale), because their netbacks will be much worse compared to the ones of refineries in Russia and the Middle East for example. A final interesting comment was made by the participant from the EC who gave a neutral score to the argument and believes that, it may be the case that acquisitions of downstream assets in Europe will indeed help to serve the demand for fuels in Asia, not now but in the future.

One of the slightly controversial arguments is that the CSO represents a cost for the industry, as it does not allow it to run down its stocks to the lowest level consistent with its operational requirements. While the argument was valued with a +2 in Factor 1 array, it received a -4 in Factor 2 array and a 0 in Factor 3 array. The participant from Vesta Terminals slightly agreed with the argument, as he considers CSOs indeed a cost, particularly for the governments and for refiners. At the same time however, he

believes that CSOs are an opportunity for trading companies, so this type of firms are probably perceiving CSOs as something beneficial for their business. The participant from Q8 slightly disagreed with the argument and she identified that CSOs are mostly affecting the activities of terminal operators. She added that it is common to see the marketing organization of Q8 asking from the refining organization support with CSOs (by buying the so-called “tickets”), as the latter does not need to have any CSOs but it still has tanks which can be used for purposes of compliance with CSOs. In any case, this participant does not believe that CSOs represent a serious cost for the industry. The fact that CSOs are not related to refineries but are affecting the business of marketing organizations of companies, was also confirmed by the participant related to the CF. This participant strongly disagreed with the argument, as a refinery does not need to have any CSOs, therefore these obligations are not a cost for a large part of the downstream industry. A final interesting comment was made by the participant from the Ministry of Ec. Affairs, who slightly agreed with the argument. He mentioned that the stockholding regimens in European countries are very different, and in some countries, CSOs may indeed be a serious cost, but in other countries it is not. For example, the way the stockholding system is designed in the Netherlands does not lead to any extra costs for the industry. On the contrary, it offers an opportunity to generate some more positive cash flows by selling tickets, because the Netherlands is a country very well provided in terms of stocks. Therefore, stocks being held in the Rotterdam area are often used as coverage for CSOs elsewhere, in other countries. However, the situation may be significantly different in other countries, where the industry may be obliged to hold all the CSOs. In those cases, the stock obligations are indeed a significant cost element for the industry.

The participants were asked to judge whether the current oversupply in the European market will end, as smaller refineries close, therefore acquisitions of refineries in the region can be justified. There was not a lot of support for this argument, which received a 0 score in Factor 1 array, a -4 score in Factor 2 array and a -1 score in Factor 3 array. Strong disagreement was expressed by the participants related to the Ministry of Ec. Affairs, Shell, the EC and the CF, while most of the other participants remained more neutral about this statement. The participant from the CF expressed his disagreement, because he considers that although refining capacity is closing down in Europe, more capacity is being added elsewhere in the world, which altogether results in an increase in refining capacity globally and not a reduction. Since the European refining sector has the most disadvantaged position probably in the world, it is likely that even more refineries will need to close in the region, so acquisitions of European refineries at this moment is not the best strategy. The participant related to Shell believes that the refining sector is heading towards overcapacity on a global level, and a resurrection of demand is not very likely in the future. The reason for the latter is that climate change considerations will keep becoming of more importance and the world will keep moving to the direction of using more green technologies, electric cars, alternative fuel sources etc. So, the combination of the future refining overcapacity and of the decreasing demand for fuels will drive investments in refineries or acquisitions of these assets in the future. From the point of view of a policy-maker from the EC, it is believed that acquiring refineries in Europe nowadays is a risky strategy. Of course there may be some exceptional cases, concerning specific refining assets which may be worth buying, but in principle the situation in the market is so bad that it would not easily justify an acquisition of a refinery in Europe. One of the participants who remained neutral towards the argument is related to ExxonMobil. He believes that overcapacity will not disappear, because despite of the capacity closures, demand will keep decreasing in the foreseeable future, especially in the OECD region. So the idea that many refineries have already closed in Europe, is not by itself a sufficient justification for acquiring refining assets in the region. Only a good opportunity where a good return can be gained, would justify an acquisition of a refinery in Europe. The participant from Vesta Terminals also remained neutral about this statement, because he

believes that although some small refineries have already been out of the market, but many more still need to close down for the revival of the European refining sector. There are some examples of firm executives expressing their optimism about the future of the sector, and this is why their firms have made some investments, but in principle, it is very difficult to judge at the moment whether it is a good time to proceed with acquisitions of refineries in Europe. Cautiousness is necessary for investors aiming in refineries.

An argument which received only one disagreement score (from the participant related to Shell), argues that most European refineries are configured to produce gasoline, however the European market demands more middle distillates, which is a major driver for upgrading investments in refineries. The argument was given a +3 score in Factor 1 array, a +1 score in Factor 2 array and a +5 score in Factor 3 array. The participants who agreed the most with this argument are related to the EC and Q8. The former one commented that the argument is true and gave the example of the recent investment announcement by ExxonMobil, where the media report that the reason for this investment is the high demand for middle distillates in Europe. Moreover, it is true that growth rates for middle distillates demand in Europe are not meant to be extravagant; however there is increasing demand for these products in many other parts of the world, therefore investing in more middle distillates is like a “safe bet”. Next to this, with investments in conversion capacity, not only a refinery can supply with more middle distillates the European and other global markets, but it can also decrease the share of gasoline it produces and solve in this way any excess gasoline issues. The participant from Q8 strongly agreed with the argument, as she stated that the production of excess gasoline is the main problem for the company’s refinery in Rotterdam. This problem is aggravated with the very low prices for gasoline in the market and the fall of demand for gasoline in the US market, which is even exporting volumes of gasoline nowadays. On the other hand, the European and the Russian markets are demanding more diesel and this is why the management of Q8 in Kuwait has now under consideration a major upgrading investment, which will enable the refinery of the company to increase its middle distillates production. The evaluation for this investment has already proceeded quite far and has reached the stage of taking the final decision, but some more months may be required for this decision to be made. The participant from ExxonMobil also gave a high agreement score to the argument and as he commented, the gasoline/diesel misbalance is one of the big challenges the European refining sector is facing. Refineries in Europe were built in the 60s or 70s when the demand for gasoline was higher than for diesel, which led many companies to invest in FCC (Fluid Catalytic Cracking) units for increasing the production of gasoline against diesel. However, the demand patterns have changes nowadays and it is not easy for a firm to adjust its refineries to the new situations because large investments are required. These investments will be realized by a company only when it perceives a good business opportunity or to put it differently, a company will invest in more conversion capacity only when it believes that the higher margins it will be getting from the middle distillates production will be sufficient to cover the investment. This is why ExxonMobil decided to proceed with the upgrading investment in its Antwerp refinery, as it is always part of the strategy of the company to keep finding profitable ways for improving its operations according also to what the market demands. Then the participant of Hestya who expressed his strong agreement with the argument, emphasized on the dilemma many refineries are facing about whether to invest or not. Although the market indeed demands more distillates and, in principle, refineries need to invest in conversion capacity to increase their production of these products, there are some inland refineries which are still enjoying good outlets for their gasoline production, as they are supplying their local markets where there is certain gasoline consumption. Although the demand for gasoline in such areas is not very high, it is still more cost-efficient for these refineries to keep supplying their local markets with gasoline than to proceed with an expensive

upgrading investment, to increase their diesel production. Participants from the Ministry of Ec. Affairs, from COVA, from FuelsEurope and from CIEP also agreed with the argument, and the latter one of them stressed that indeed most refineries in Europe are of low complexity and thus they are not capable to produce more diesel instead of gasoline, whereas maybe even 2/3 of the market demand for fuels is concerning diesel. Furthermore, he agreed with the participant from the EC that although diesel demand stagnating in Europe, it is growing in other markets all around the world, so indeed this may be a good incentive to upgrade refineries and increase the production of middle distillates. Nevertheless, whether this demand and supply misbalance is a major driver for upgrading investments in European refineries is bit questionable. It is more likely that this problem in the market is a major driver for policy changes, rather than for investments in European refineries. A policy change is more important, because many European governments or the EC are regulating in favor of diesel use, while gasoline is becoming a cleaner fuel, a cleaner burning fuel than diesel. So it would be wise to consider a change of this dieselization trend, through a policy change itself. Of course, this would probably raise other competitive pressures for European refineries as they would have to compete with their counterparts worldwide, for supplying the markets with cheap gasoline. To conclude, it is a very difficult task to solve the problems of the European refining sector, due to the mismatch between demand and supply for fuels. Two of the participants who gave a neutral score to the argument under discussion, are related to BP and Vesta Terminals. The former believes that the European market is to the level that the business climate is geared towards more middle distillates, but not to this level that would satisfy European demand for these products. Proceeding with upgrading investments in the only thing a refinery can do to solve its gasoline/diesel production misbalance problems. The participant from Vesta Terminals agreed that indeed, many European refineries built in the 60s or 70s are gasoline-heavy, however the market nowadays demands more diesel and this had led to some upgrading investments in some refineries to increase their diesel production. So the increased middle distillates demand has been an important driver for upgrading investments in the past and it may still be in the future, however to a lesser extent. The time dimension was emphasized also by the participant related to Shell, who commented that the argument was very true maybe 10 years ago but it is not so relevant nowadays. The gasoline/diesel misbalance problem was a major driver for upgrading investments in the past. Nevertheless, although nowadays it may not be such a strong driver, it still remains a driver.

An argument which received a high score (+4) in Factor 3 array, but significantly lower scores in Factor 1 and 2 arrays (-1 and 0 respectively), argues that acquisitions of less profitable downstream assets in Europe, are justified for reasons of extended (foreign) policy reach through energy market control. A participant who strongly agreed with this statement is the one related to Q8, who commented that political considerations are definitely driving many of the investment decisions of Q8. Of course, this is not the case for the major oil companies, as it was confirmed by the participant from ExxonMobil who gave a neutral score to the argument. However, there are several other NOCs which are having the same rationale like Q8. The fact that political considerations play a big role in the decision making of Q8 is something to be expected, as it is a Minister in Kuwait who is taking decisions about the company. When the Minister is changing, the strategy of the company is also changing. Moreover, a country like Kuwait intends to have good relationships with European countries, like the Netherlands, and this is one more reason why Q8 remains present in this country by operating a refinery in Rotterdam. If it would be only economic or business considerations involved, the company would have sold the refinery. However, the political and strategic considerations are the ones which are making Q8 to continue being present and operating the plant. The participant from the EC was more neutral about the argument and he mentioned that it is not clear if these political considerations are indeed so important for the new entrants coming into Europe. For example, Lukoil has made investments but it is

not easy to identify it there are non-economic drivers behind their decisions, as Lukoil is a private company without close ties with the Russian government. Nevertheless, there are other companies, such as the ones from India and China for example, which are acquiring assets in Europe mainly for storage purposes, where it is more clear that there are political or other strategic drivers behind their actions, given the current economic state of the market in this region. So there are examples of firms taking decisions based not only on business criteria. The participant who disagreed the most with the argument, is the one related to CIEP. He argued that there is often a tendency in this part of the world (Western Europe) to overestimate this kind of political considerations, when a NOC from an emerging market will invest in Europe. This way of thinking is incorrect because even for NOCs from emerging economies, economic realities go first and then political realities follow in their decision making processes with respect to investing, at least in Europe. These companies will first consider whether an asset is valuable for their business and then they will investigate the geopolitical considerations coming with it. The participant from Vesta Terminals, who slightly disagreed with the argument, shares the same opinion. He believes that investments from companies in Europe are firstly driven by an evaluation on whether they can be profitable and add value to the business, and then all the other geopolitical considerations follow. The latter are always playing a role, but they are falling behind the economic considerations about an investment opportunity.

A rather controversial argument considers as a major reason for divesting downstream assets, the willingness to boost the stock price of a firm and/or increase dividend payments to shareholders. This argument received a neutral score in Factor 1 array (0), a positive score in Factor 2 array (+3) and a negative score in Factor 3 array (-4). From the participants who strongly disagreed with the argument, the one related to Q8 mentioned that this is an argument not so applicable to a NOC like Q8. The participant related to Hestya, who also strongly disagreed, considers that stock price and dividend payment considerations are not very important drivers for divestments. They might play only a small role in a decision and especially for the major oil companies, selling an old, simple refinery in Europe, is not something of increased importance in their greater scheme of things. The participants who agreed most with this argument are related to the CF, ExxonMobil and the EC. The latter one believes that stock price and dividends considerations can indeed be a significant reason for divestments of unprofitable downstream assets, particularly by the vertically integrated oil companies, as the refining activities are the ones which are deteriorating their financial results. The participant from the CF also agreed that for the vertically integrated major oil companies, divestments of loss-making downstream assets can be done for financial considerations. Furthermore, sometimes it is almost an obligation for them to be seen by the market analysts, doing these divestments, and although this is not a very sensible reason, it remains true. The participant related to Shell gave a neutral score to the argument, however he believes that it is probably true. The market is indeed looking for active portfolio management, so divestments of unprofitable downstream assets are necessary. However, proceeding with this type of divestments should be seen by a firm as a proper way of managing its business, and if it does that, then its stock price will eventually respond. An interesting comment was made by the participant related to Vesta Terminals, who slightly agreed with the argument. He considers that financial considerations are indeed an important reason for divestments of downstream assets, especially by the major oil companies. This is a bit short-term strategy but it fits into the more general effort of this type of companies to improve their capital allocation, in order to ensure it yields high returns. Part of this effort is also the decision to focus more on their upstream –more profitable– operations.

An argument which is related more to conversions of refineries in Europe states that a major reason for acquiring European refineries and converting them to storage facilities for trading purposes, is that an

established site simplifies compliance for environmental regulations. This argument received lower scores in Factor 1 and 3 arrays (-3 and -1 respectively), and a +2 score in Factor 2 array. The participants who agreed more with this argument are related to COVA and ExxonMobil, while most disagreement was expressed by the participants from FuelsEurope, Vesta Terminals, Q8, Ministry of Ec. Affairs and TU Delft. The participant from FuelsEurope mentioned that the major reason many refineries close down and are converted to storage facilities, is the general market downturn and the fact that many of these refineries face high costs and have low flexibility. The pressure due to environmental regulations is also a factor which adds some more pressure to refineries, but it's not a major factor driving closures of refineries and conversions to terminals. The participant from Vesta Terminals emphasized that on the one hand, yes it may be easier to convert an existing refinery to a terminal than to build a new facility, but on the other hand there have been no new refineries built in Europe for decades, while there have been new terminals or storage facilities built. So constructing new terminals is not, in the end, so difficult, and a conversion of an existing refinery to a terminal does not really offer a great advantage. Participants related to BP and Shell gave a more neutral score to the argument and they both agreed that the main reason many refineries are being converted, is that their closure costs are too high. It is an obvious option which costs less to a firm and it also offers the opportunity to use the site for trading. Moreover, setting up a new trading hub can be a very difficult task in some cases, particularly in regions where there is strong opposition for environmental issues. In these cases, buying old refineries in the region and converting them to terminals may indeed be a good strategy for creating a trading hub.

Participants were asked to evaluate the argument that acquisitions of refineries in Europe, is a good way to secure downstream outlets for your crude oil production and have a more efficient planning of output over time. This argument was given a -2 score in Factor 1 array, a 0 score in Factor 2 array and a +3 score in Factor 3 array. Participants related to Shell, FuelsEurope and ExxonMobil disagreed with this argument. However, most of the comments about this argument are from the participants who agreed with it. The participant from the Ministry of Ec. Affairs believes that for many NOCs, downstream vertical integration with acquisitions of refineries in Europe may indeed be driven by a strategy to ensure their supply of products to the European market. There is for example the case of the Russian oil company which invested in the Zeeland refinery in the Netherlands. For this company, this investment is probably driven by the strategy of gaining a foothold in the European market for its crude oil output. The participant from Q8 strongly agreed with the argument and she confirmed that for a NOC from Kuwait for example, having a refinery in Europe is definitely perceived as a way of securing an outlet for its crude oil production (which is produced in Kuwait). The participants from Hestya and from Vesta Terminals referred to the Asian players, like Essar, and to some trading companies, like Gunvor, who are entering the European market. For the former, acquisitions of European refineries are certainly a way of securing an output for their crude production. For the latter, acquisitions of refineries that can process specific types of crudes offers more flexibility and can enable them to optimize their fuels production planning. On the contrary, the participant related to the CF agreed only slightly with this argument. As he commented, normally this argument would be valid but there are not many NOCs acquiring refineries in Europe for reasons of securing a downstream outlet for their crude production and having a better planning of output over time. There is no obvious connection between acquisitions of refineries and the previous considerations. The case of Gunvor, which acquired the Antwerp refinery in an effort to be able to manage more efficiently its crude flows, maybe can be seen as exceptional. Let alone that Gunvor proceeded with this acquisition based on a trading and not a crude oil producer mentality.

An argument which is related more to the trading business, states that a major reason for acquiring refineries and/or storage facilities in Europe, is the region's strategic location which offers global connectivity and increased trading potential. This argument received a -2 score in Factor 1 array, a -1 score in Factor 2 array and a +2 score in Factor 3 array. The participants who agreed most with this argument are related to Hestya and Q8, and the first one of these two strongly agreed because he believes that Europe is still a huge demand and commission center, so firms are still interested in acquiring assets in this region. The participant from ExxonMobil who agreed, but to a lesser extent with this argument, mentioned that this is indeed an important consideration especially for trading companies. Europe still is a big market and there is indeed strong connectivity with other markets, so it is advantageous for a firm to have presence in the region. The participant from Vesta Terminals also slightly agreed and made a comment about the fact that there are certain regions in Europe which are indeed major trading platforms, like the ARA area. From these areas it is possible to supply West Africa, Russia and other regions. However, the argument is not so true when Europe as a whole is considered. Europe is not a trading hub for the whole world and if a firm intends to supply Asian markets, is much better to do this by acquiring assets in Singapore for example. Of course the European region is still a big market, particularly for diesel, so this may be an important reason to invest but there are no important reasons for investing in region because of its connectivity; the whole world is very well connected nowadays. He participant from CIEP also agreed that the strategic location of Europe is not so great, considering that the North American continent is going to be self-sufficient in fuels supply in the future and that there may be increasing trading volumes between Asia and the Middle East. In such a scenario, Europe doesn't seem to have such an advantageous position to serve global markets. A last comment to mention here was made by the participant from the Ministry of Ec. Affairs who strongly disagreed with the argument. He believes that Europe has refining overcapacity and it is already well-connected with the rest of the world (the region has been exporting its gasoline surplus for years), so there is no strong reason for a firm to acquire refineries or storage assets in the region.

One of the more controversial arguments the participants were asked to evaluate, considers as a major reason for exiting the refining business in Europe the strong labor laws and high wages in the region. The argument was given a +1 score in Factor 1 array, a 0 score in Factor 2 array and a -3 score in Factor 3 array. Strong disagreement about this statement was expressed by the participant from COVA who believes that despite of the fact that wages are indeed high in Europe, they represent only a very small part of the cost of refiners, so in the end wages is not the major reason for exiting the refining business. More important reasons are the falling demand and the changes in demand patterns, along with the competition European refiners face worldwide. The participant related to Q8 also expressed her strong disagreement with the argument by emphasizing that wages are not the highest cost in the refining business. On the other hand, the cost of energy and maintenance is much higher and this is the one that is really affecting more the business and not the cost for wages. Furthermore, labor laws are also not so strict, at least in the Netherlands. Therefore, wages and labor laws are definitely not the major reasons for exiting the refining business in Europe. The participants related to BP, TU Delft and ExxonMobil slightly disagreed with the argument and the latter one explained that, indeed wages are higher in Europe than in Asia for example, which of course affects to an extent the refining business in Europe, but this is not a major driver for exiting this business. More drivers than only this one are responsible for the trend of firms moving away from refining in Europe. After all, wages may be higher in the region, but also the productivity in Europe is one of the highest in the world, so the disadvantage of having higher costs for wages is balanced in a certain way by higher productivity gains. On the contrary to the aforementioned participants, the one related to Vesta Terminals strongly agreed with the argument, as he considers the labor costs as extremely high in Europe, both in the trading and the refining sector.

According to his opinion this is one of the biggest problems the European downstream sector is facing, which becomes even worse considering that the sector is in general making losses, and it is very difficult to deal with this problem because of labor unions. Other participants who also agreed (to a lesser extent) with the argument are related to FuelsEurope, the EC and Hestya. The last one of them emphasized that labor costs are playing an important role in creating difficulties for European refiners, considering that refiners are also burdened with other high costs due to environmental legislation, taxation on emissions, other legal issues etc. These costs altogether are driving refining companies to exit the business in Europe. From the point of view of the participant from the EC, labor costs are indeed an important reason affecting the business of refiners in Europe, especially when the same costs in other parts of the world are much lower for their competitors. This is a problem not only for the refining industry in Europe but also for other industries. Last but not least, the participant from the Ministry of Ec. Affairs gave a more neutral score to the statement. He commented that although high wages in Europe is decreasing the margin of European refineries more than elsewhere in the world, it still remains a small fraction of the total cost for refiners. A much more important element is the high energy costs in Europe, which are affecting severely the margins of refiners and maybe driving them out of the business.

Participants in the research were asked to evaluate the argument mentioning that asset-light strategies are preferred in Western Europe, due to the region's liquidity in petroleum products, good infrastructure, low refining margins and inadequate raw materials base. This argument received an agreement score (+3) in Factor 2 array only, as it was given a neutral score (0) in both Factor 1 and 3 arrays. There was strong disagreement expressed about this statement from the participant related to Hestya, who stressed that firms are interested in assets in Europe. It is very unlikely to see a refinery in North-Western Europe shutting down completely and not being used anymore (apart from maybe some exceptions in France). The vast majority of refineries in the region will remain operational either as fuel production sites or, after conversion, as storage sites. Participants related to FuelsEurope and Vesta Terminals also disagreed with the argument. The latter mentioned that although it is true that in Western Europe there is indeed good infrastructure and a firm does not need to own a storage asset, as it can easily rent it for example, this is still not a major driver for following an asset-light strategy. Especially concerning the trading companies, all the major players still have a "vest" in Europe because it is good place to be there physically. Furthermore, there are many differences between Western and Eastern Europe, they are completely different locations, and thus possessing assets is not so attractive everywhere across Europe as a whole. Apart from disagreement, the argument under discussion was given also agreement scores by some participants, such as the ones related to Shell, CIEP, TU Delft and the Ministry of Ec. Affairs. The one who agreed the most was the participant related to Shell, who believes that refining margins in Europe are low and will remain low in the next couple of years. The previous consideration coupled with the increased liquidity in the market in Western Europe, is indeed forcing refiners in the region to work with the minimum invested capital in an effort to reduce costs. Hence, asset-light strategies are becoming indeed more attractive. The participant from CIEP also agreed to a great extent with the argument, as he considers that following an asset-light strategy would be the most rational thing a firm would do, in a market characterized by good infrastructure and low refining margins –like the (Western) European market. Asset-light strategies make perfect sense in such a market, even more so when taking into account that there are no prospects for growth in the region.

### *Answering the third research sub-question*

The previous item-by-item discussion offered a comprehensive overview of what the stakeholders (participants) in the European downstream oil sector, consider as a more or less important driver for corporate investments or divestments. This discussion is actually the answer to the third research sub-question of this thesis:

*“How do different stakeholders in the European downstream oil sector perceive the aforementioned drivers in terms of validity and importance?”*

However, what still remains is to discuss specifically about the items which are perceived as the most or least important from the participants. This follows in the next paragraphs.

#### **5.4.4 What counts most?**

After presenting how participants perceive all of the items included in the Q set and after giving a comprehensive overview of the similarities or differences among their viewpoints, the discussion has reached the point where the most and least important drivers for investments or divestments in the European downstream oil sector, have to be highlighted. Specific items are selected and presented in this paragraph, in order to help answering the main research question of this report. The selection of the key items to be discussed was based on a single criterion; all items were scanned (consensus, controversial, other items) and they were taken into account those items which received a +5, +4, -5, or -4 score in at least one of the three Factor arrays. It is believed that in this way it is possible to take into consideration as much of the diversity in opinions and beliefs, as possible. Of course, the focus is on the extreme values the items received, because these values represent strong agreement or disagreement with the items and this is what the author of this thesis would like to emphasize on. Furthermore, strong agreement or disagreement indicates also the importance of the drivers described in the items, in the participants' perception. In the end, from the initial list of 42 items, 25 were deducted, which give a complete picture of what drives or not the decisions of firms to invest or divest in the downstream oil business in Europe.

The general level of agreement or disagreement with these items is reflected in the number of (+) or (-) symbols they have received. It is necessary to mention that every item was assigned a (+) for every +4 or +5 it was given in any Factor array. Moreover, the items about which there was consensus and agreement by all participants were given an extra (+) as a bonus, in order to emphasize their importance for all participants on average. All consensus items are indicated by the bold font. So for example item 2 received +1, +5, +3 in Factor arrays 1, 2 and 3 respectively, and therefore it was given a (+) for its sole +5 score and one more (+) because it received positive scores in all Factor arrays. On the other hand, item 8, which has -1, 0, +4 scores in the three Factor arrays, received only one (+) for its sole +4 score. The same logic applies for the items about which there was disagreement.

Table 7: Most noteworthy items.

| Item No. | Items/Drivers                                                                                                                                                                                                                         | Level of agreement (+) or disagreement (-) |       |     |   |   |     |       |
|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|-------|-----|---|---|-----|-------|
|          |                                                                                                                                                                                                                                       | +/+/+/+                                    | +/+/+ | +/+ | + | - | -/- | -/-/- |
| 11       | The substantial surplus of refining capacity in Europe can only lead to divestments of refining assets.                                                                                                                               | X                                          |       |     |   |   |     |       |
| 31       | A major reason for converting unprofitable European refineries to terminals is mitigation of potential closure costs (including environmental, demolition, employee compensation and legal costs).                                    |                                            | X     |     |   |   |     |       |
| 15       | Most European refineries are configured to produce gasoline, however the European market demands more middle distillates, which is a major driver for upgrading investments in refineries.                                            |                                            |       | X   |   |   |     |       |
| 2        | The fall of demand for gasoline in the US market is a significant driver for divestments in the European downstream oil sector.                                                                                                       |                                            |       | X   |   |   |     |       |
| 20       | The higher volatility and lower returns from investments downstream, than the ones from investments upstream (crude oil production), are a major driver for divestments of downstream assets in Europe.                               |                                            |       | X   |   |   |     |       |
| 35       | The mature European downstream market makes attractive the option to divest downstream assets in Europe and refocus on a strong downstream presence in other growth markets.                                                          |                                            |       | X   |   |   |     |       |
| 9        | Retaining sufficient refining capacity in Europe is a key factor for the region's energy security.                                                                                                                                    |                                            |       |     | X |   |     |       |
| 6        | Changes in supply and demand patterns in Europe is a major reason for acquisitions of storage facilities or conversion of refining facilities to storage in the region, to help handle the new commodity flows.                       |                                            |       |     | X |   |     |       |
| 26       | Weak corporate balance sheets and the difficulty to access credit is a major barrier for investments in the European refining sector.                                                                                                 |                                            |       |     | X |   |     |       |
| 8        | Acquisitions of less profitable downstream assets in Europe, are justified for reasons of extended (foreign) policy reach through energy market control.                                                                              |                                            |       |     | X |   |     |       |
| 25       | European refineries cannot compete with the new refineries in Asia and Middle East, as the latter are of high complexity and scale, and this works mostly as a driver for upgrading and expansion investments in European refineries. |                                            |       |     | X |   |     |       |
| 21       | Acquisition of midstream fixed logistic assets leads to better and faster exploitation of arbitrage opportunities.                                                                                                                    |                                            |       |     | X |   |     |       |
| 32       | A major reason for converting unprofitable European refineries to terminals is reduction of the plants' costs and release of working capital.                                                                                         |                                            |       |     |   | X |     |       |
| 28       | A major reason for divesting downstream assets is to boost the stock price and/or increase dividend payments to shareholders.                                                                                                         |                                            |       |     |   | X |     |       |
| 5        | The high taxes on emissions in Europe is a major driver for divestments of refining assets.                                                                                                                                           |                                            |       |     |   | X |     |       |
| 10       | The Compulsory Stock Obligation (CSO) represents a cost for the industry, as it does not allow it to run down its stocks to the lowest level consistent with its operational requirements.                                            |                                            |       |     |   | X |     |       |
| 19       | The current oversupply in the market will end, as smaller refineries close, therefore acquisitions of refineries in Europe can be justified.                                                                                          |                                            |       |     |   | X |     |       |
| 7        | The need to comply with the European environmental legislation (including biofuels mandates), works mostly as an incentive for upgrading investments in refineries.                                                                   |                                            |       |     |   | X |     |       |
| 1        | The growing competition European refiners face from their Russian counterparts in the European market, works mostly as an incentive for upgrading investments in European refineries.                                                 |                                            |       |     |   | X |     |       |
| 24       | Local opposition is a major barrier for expanding or upgrading refining facilities in Europe.                                                                                                                                         |                                            |       |     |   | X |     |       |
| 13       | The growing competition European refiners face from their US counterparts worldwide, works mostly as an incentive for upgrading and expansion investments in European refineries.                                                     |                                            |       |     |   |   | X   |       |
| 40       | The higher freight costs for moving refined products to Europe from outside the region, than the costs for moving crude oil, is a major reason for investments in refineries located in Europe.                                       |                                            |       |     |   |   | X   |       |
| 16       | A major reason for acquiring storage facilities or converting refineries to storage in Europe, is compliance with compulsory stock obligations.                                                                                       |                                            |       |     |   |   | X   |       |
| 3        | A major driver for acquiring downstream assets in Europe is because is a good way to help to serve the growing demand for fuels in Asian countries.                                                                                   |                                            |       |     |   |   | X   |       |
| 41       | Asset-heavy strategies are becoming attractive because of the rise of financing and transaction costs due to regulatory changes in the banking and derivatives-trading environment.                                                   |                                            |       |     |   |   |     | X     |

To begin with what is driving divestments; all participants on average agree that one of the most important drivers for divestments of refining assets in Europe, is the substantial surplus of refining capacity and this is in combination with the fall of demand for gasoline in the US market. The trend of having particularly many IOCs divesting assets in Europe can be largely attributed to their strategy of releasing capital and investing it in their upstream business, where there are higher returns. Next to this, one more important reason for divesting downstream assets in Europe is also considered to be the desire of firms to invest in the downstream market of emerging economies. The aforementioned are acknowledged as important divestment drivers, by all participants on average.

Not surprisingly, there are other factors which are much more important divestment drivers according to the point of view, of only specific stakeholders. For example, in terms of competition, the pressure European refineries face from their US and Russian counterparts, is believed to be driving mostly divestments in the industry, rather than investments. There are, however, contradictory opinions about the effect of competitive pressures from these regions, as for some of the stakeholders the competition is a factor stimulating investments. Divestments are also driven by the obligation to comply with the European environmental legislation, according to several stakeholders. Voices opposing this argument believe that compliance with environmental mandates is not playing such an important role in taking decisions to divest assets. One more argument which raised controversy has to do with whether taxation on emissions is an important reason for considering divestments. For some stakeholders this is a very important burden for the industry and therefore an important driver for divestments, whereas other stakeholders do not agree at all that this factor is a major reason for divesting. A last source of controversy concerning what drives divestments is related to whether a company considers selling or closing assets because it aims to boost its stock price or increase the dividend payment to stakeholders. This is something which indeed holds true mostly for the major oil companies and not so much for other players in the industry.

In terms of what is driving investments of any form –including acquisitions of assets– all actors agree on average upon certain issues. First of all, they all share the opinion that the increased demand for middle distillates in the European market is a very important reason to invest in upgrading gasoline-heavy refineries, when a good business opportunity is perceived. On the other hand, the rise of financial and transaction costs due to regulatory changes in the banking and derivatives-trading environment, is not in principle perceived to be an important reason to become more asset-heavy. Moreover, investments and particularly downstream assets acquisitions Europe, are certainly not stimulated by a reason of aiming to serve the growing demand for fuels in Asian countries. The difference between the freight cost of transporting crude and refined products from outside the region to Europe, apart from not being so large anyway nowadays, is definitely not stimulating investments in refineries in Europe.

The harmony among the different stakeholders' opinions, about what is driving investments in the European downstream oil sector, is disrupted when other considerations are taken into account. For some of the stakeholders in the industry, the contraction of the European oil refining industry may very well endanger the region's energy security, so it has to be ensured that some capacity will remain operational in Europe. However, not all stakeholders consider that capacity closures can indeed create important energy security problems, due to the liquidity of the market. Concerning the competition the European refining sector is facing from refineries in Asia and the Middle East, all the actors agreed that European refineries cannot compete with them. Disagreement was raised though about whether this situation works as an incentive for upgrading investments or for divestments in the European refining

sector. Some stakeholders are more optimistic as they believe that in the presence of some necessary preconditions (mainly a good location), it is meaningful for a refinery to invest in order to compete with this form of external competition. In the end, refiners cannot simply remain observers and hope for the market conditions to change; they have to invest otherwise they will be soon out of the business. On the contrary, the more pessimists (or realists) do not see any driver for investments due to the competitive pressure from the East of Europe; they rather perceive drivers for divestments. When it comes to geopolitical considerations and whether these are driving investments in, often unprofitable, refineries in Europe, it is interesting to comment that although most stakeholders do not believe so, there is a minority of stakeholders which attaches a lot of value on these considerations when firms are deciding for investments. For the majority of actors, geopolitics follow business, but the author of this thesis believes that had there been more people from NOCs involved in this research, the picture would probably be different. Apart from the drivers there are often barriers hampering investments. Financial considerations, such as difficulty to access credit and weak balance sheets, are an important factor prohibiting investments particularly for smaller companies, such as independent refiners etc. The major oil companies have a significantly better financial position, so in their case this barrier does not exist, however their financial resources are also not unlimited and investments are realized where they can be the most profitable (mostly upstream). On the other hand, local opposition is not in principle considered a major barrier to upgrading or expansion investments in European refineries, considering the situation in the market nowadays. There are some cases where investment plans were blocked due to such reasons, but these are more the exceptions that prove the rule. Last but not least, the general feeling of stakeholders about the refining overcapacity in the industry is that it will continue to exist in the next years. More refineries, especially some smaller, non-complex ones, will have to close eventually and since the demand is contracting faster than capacity, the European refining sector will keep being saddled by overcapacity problems. This said, acquisitions of refineries in Europe, is not believed to be a clever strategy by the vast majority of stakeholders.

In this last paragraph, the focus will be more on what is driving conversions or European refineries to storage or acquisitions of storage assets and terminals in general. A very important reason for converting unprofitable European refineries to storage is the mitigation of potential closure costs, and all actors involved in the industry agree with this argument. However, not all of them share similar ideas about the importance of drivers for conversions, such as the reduction of the plant costs and the release of working capital. Even though some stakeholders believe that these are drivers that indeed play a role (but not a major one), there are others who strongly disagree with this argumentation. To touch upon one other issue, the majority of stakeholders do not perceive compliance with CSOs as a major driver neither for conversions of refineries nor for acquisitions of storage assets. Converting a refinery to storage and using it for holding stocks means there is no better use for this asset, and it is the last option the plant operator has before closing down the site completely. CSOs themselves are perceived by some stakeholders to be adding a cost to the industry, not in the Netherlands, but mostly in other European countries. Nevertheless, there are other stakeholders, who strongly disagree with this and don't see CSOs putting really any pressure on the European downstream oil sector. When it comes to acquisitions of storage assets in Europe, these are driven by two important dynamics according to the point of view of certain stakeholders; the first is because of the changes in supply and demand patterns in Europe, which creates the need to have storage assets and terminals in order to handle the new commodity flows, and the second is because ownership of these midstream assets leads to better and faster exploitation of arbitrage opportunities. Of course, some stakeholders believe that the aforementioned are very strong incentives for acquisitions of midstream assets; however, as in

most of the cases of drivers described in these paragraphs, not all stakeholders agree and share similar ideas.

### *Answering the main research question*

What was presented and discussed in the previous paragraphs actually constitutes the answer to the main research question of this research:

*“Which are the most important drivers behind corporate decisions for investments or divestments in the European downstream oil sector?”*

The last comment that can be made at this point is that, as it was verified from the Q sorts of participants and from the qualitative questions, perceptions of different stakeholders about the dynamics in the European downstream oil sector vary significantly. This was revealed with even a small sample of participants, so it could be reasonably argued that there is much more diversity to be discovered if more stakeholders are involved in such a research. This diversity exactly reflects the complexity of the challenges the sector is facing nowadays and helps explain why there is not an easy answer to the question of what has to be done and how it has to be done, in order to prevent the further contraction of the sector and help it revive and regain its competitiveness. The burden is heavy particularly for policy makers who are trying to answer this question, because they have to take into account most of this diversity in order to have a better understanding of the problem. This is essential in order to be able to anticipate correctly how the industry is likely to react to future policies, aiming to support the European downstream oil sector to get back on its feet. Even more so, it is essential in order to be able to carefully design and implement effective policies.

### **5.4.5 Important drivers underrepresented or missing from the Q set**

All the important drivers for investments or divestments in the European downstream oil sector have been presented, according to how the stakeholders evaluated them during the Q methodology interviews. However, it was already clarified in paragraph 4.3.3, that the interviewees were also asked during the interviews, about missing or underrepresented drivers in the Q set list of items. It is worth highlighting at this point the most important of their comments;

- At first, it was emphasized by several participants that an important element driving down the profitability of refineries in Europe is the high energy costs. The truth is that energy costs was not explicitly mentioned in one of the items selected for the Q set, but it was part of the argumentation about how the competition from the US refining sector (where energy costs are low) is affecting the European refining sector (where energy costs are higher).
- Another important element affecting the European downstream oil sector is the threat of substitution from alternative fuels and renewable energy sources. All these substitutes are gaining ground and are contributing to the decreasing demand for fossil fuels in Europe, which by itself has a major impact of profitability of refineries. On top of that, it seems that for many of the participants, what is more problematic is the pace that the EC and the European governments want to follow with respect to making the transition from a fossil fuel to a non-fossil fuel society. This is particularly reflected in the EC mandates. There is an effort to make this transition as fast as possible, without considering some important economic consequences (e.g. price for electricity) for society and for the competitiveness of the whole European refining sector. In the end, this trend

puts tremendous pressure on European refiners, mostly because of the decreasing demand for fuels. However, it is possible to have policies leading to a greener industry and a greener society, without harming the competitiveness of the European refining sector. A different approach, particularly from the EC is required for this to happen, and it seems that indeed the way of thinking of European policy makers has changed. It is not that environmental mandates will relax –the EC still remains committed to the goal of a carbon-free Europe– but now, more attention is paid as well on the impact of these mandates on many European industries (oil, aluminum etc.). This is why the so-called “fitness-checks” are taking place.

- An interesting remark was also made about what will eventually happen in Europe with the shale oil and gas technologies. If the “shale revolution” will reach Europe, this is expected to change drastically the competitiveness gap between the European and the US refining sector, as the costs for the former will drop and probably a large part of the competitive advantage of the latter will disappear.
- An issue which is not represented in the list of drivers for investments and divestments which was presented before the participants, is the issue of players entering the European downstream oil sector by buying assets in low prices and selling them in high prices. Indeed, there are players who have short-term strategies and act more as speculators rather than as serious investors.
- It was also commented that many of the drivers for divestments will become more or less important in the future, according to geopolitical developments (relationships with Russia or other countries), the market evolution, the future economic climate and the future regulatory frameworks, especially about environmental issues. Moreover, the relative importance of some drivers will change, if the role of EC will change as well, from being merely an oil market observer, to becoming an active player who intervenes more often in the market.
- The nature of the future oil industry will also change the relative importance of some drivers for investments or divestments. If the industry will move to a more geographically “compartmental” model, where oil markets are not so open and interconnected, then refiners will need to be present not only in Asia or North America but in Europe as well, as it will be more difficult to import and export products between different regions.
- What was also revealed to be an important driver for asset acquisitions by traders, is the necessity to be backed-up by physical assets due to banks’ requests to be so. Banks oblige traders to have assets in order to facilitate them financially and hence, it has become a necessity for traders nowadays to have assets on their balance sheets.
- One very important argument is that the list of items is lacking a consideration about how different companies take different decisions, based on their different corporate cultures and on their different decision making processes. Decision making in IOCs takes much more time than in smaller companies, and the focus is only restricted on financial considerations. However, the mentality is completely different for example in NOCs or in independent refiners, where investments are often based also on political considerations or on a “family” mentality respectively. In small firms, which in cases may be family-owned, profits may be spent back on the building and office facilities, to keep them “shiny and modern”, because this is how these firms demonstrate their profitability. An IOC would never be interested in spending capital in a building, because buildings do not generate profits. The leverage policies among oil firms also differ, as some of them may be more reluctant to borrow capital from banks, than others. Some firms may have the mentality of trying to generate first the cash flows to be used for further investments, rather than simply use more debt. All of these considerations are important company-culture-specific considerations, which are not reflected so much in the list of items. The issues represented in the Q

set are concerning more the external factors and business environment, which are all affecting firms' decision making processes for investments or divestments.

#### 5.4.6 Assessment of the usefulness and suitability of the TCE/TCR framework

The discussion in this Chapter, about what is driving corporate investment or divestment decisions in the European downstream oil sector, has been, so far, concerned only with the results of the Q methodology research. The participants' opinions have been presented in detail, as well as their arguments for their choices to evaluate positively or less positively an item from the Q set. These results however create room for a debate about whether the theoretical predictions offered by the TCE and TCR theories and the framework proposed in Chapter 3, are verified or falsified by the participants. In other words, these results offer the means to test in practice the applicability and the predictive power of the theories used for describing the nature of the European downstream oil sector.

The starting point for this discussion will be to consider the arguments that drew most of the attention of participants, either this was expressed by agreement or disagreement opinions. These items were presented in Table 7. It is also important to mention that throughout this analysis, there is the assumption that a higher amount of investments in the European downstream oil sector, indicates a willingness of companies to remain or become more vertically integrated downstream in Europe. Similarly, more divestments indicate towards a lower degree of downstream vertical integration in Europe.

#### *Items which received higher attention by the participants*

At first, the participants strongly agreed that the substantial surplus of refining capacity in Europe can only lead to divestments of refining assets. This argument is related to the demand volume uncertainty element of uncertainty construct, because the surplus of refining capacity can be largely attributed to the decreasing demand. There is diminishing uncertainty about the future demand for oil products in Europe (all forecasts are projecting decreasing demand) and in such a case, the TCE theory would consider the market as a more appropriate form or governance. Indeed, divestments of refining assets in Europe, or in other words downstream vertical disintegration in Europe, seem to be inevitable in the eyes of participants. Moreover, there are numerous refiners and traders in the European market, constituting it very liquid, so no small-numbers issues are present. In this case, the theory again predicts that there is no need for hierarchical governance structures (through vertical integration) and the transactions can be conducted more efficiently in the market. So this prediction is also verified by the viewpoint of participants.

Mitigation of potential closure costs (including environmental, demolition, employee compensation and legal costs), is largely perceived as a major reason for converting unprofitable European refineries to terminals. The unprofitable refineries are highly site-specific assets and they cannot easily be relocated or demolished at low cost. Moreover, there is a small-number of potential buyers for these assets, putting sellers in a disadvantaged bargaining position. In the case of high site specificity and small-numbers situations, the theory predicts that hierarchy is preferable to vertical disintegration; indeed, the participants believe that firms would prefer to keep these unprofitable refineries in their portfolio, even if they have to be transformed into terminals.

An item which is closely related to the dimension of physical asset specificity states that most European refineries are configured to produce gasoline, however the European market demands more middle distillates, which is a major driver for upgrading investments in refineries. Refineries are assets highly physical-specific, as if they are configured to produce gasoline and the transactions in the market are concerned with middle distillates, their value, as assets, is diminishing. Hence it is necessary for a firm possessing this type of physical-specific assets to invest in them in order to maintain their value according to the market fluctuations, and it is preferable to maintain these assets in its portfolio (to employ hierarchical governance strictures). Almost all participants agreed with this argument which highlights the validity of the theory.

Most participants also agreed that the fall of demand for gasoline in the US market, is a significant driver for divestments in the European downstream oil sector. This fall in the demand can be connected to the notions of unpredictability of the environment (shale oil revolution developed faster than expected) and demand volume uncertainty. Although the higher unpredictability of the environment would normally lead firms to become more vertically integrated downstream, the low demand volume uncertainty, as demand for European-made gasoline in the US market is expected to keep contracting, has the opposite effect. Due to the low demand volume uncertainty, firms involved in the refining business in Europe prefer to employ the market governance structure for their transactions, so they vertically disintegrate downstream by divesting assets. It seems therefore that participants verify the premises of the theory in this case.

Then it is the argument that the higher volatility and lower returns from investments downstream, than the ones from investments upstream (crude oil production), are a major driver for divestments of downstream assets in Europe. This argument received support from almost all participants. It is obvious that the high unpredictability of the environment in the downstream business in Europe, leads many firms (particularly IOCs) to vertically disintegrate downstream. However, the theory would suggest the opposite in such a case. Moreover, the argument is not valid for all types of firms involved in the European downstream oil business, as there are oil companies which are operating refineries and do not have upstream operations. These firms have different capabilities and business models, so they may be in position to keep operating downstream assets in Europe profitably. It seems therefore that there is a limitation of the theoretical framework developed in this research, which cannot adequately explain the participants' opinions about the argument.

The last argument which was evaluated positively by most participants, states that the mature European downstream market makes attractive the option to divest downstream assets in Europe and refocus on a strong downstream presence in other growth markets. Obviously, the mature European market has reduced the demand volume uncertainty for oil products (demand is declining), and the theory predicts that the lower the uncertainty, the lower are potential transaction costs and so, executing transactions in the market is more efficient. Participants agreed that disintegrating vertically in Europe (with asset divestments) is more attractive under the current market conditions, so the theory prediction was verified. However, here comes again the issue of having different firms with different resources and capacities, which means that not all of them are capable or willing to focus on the downstream business of other growth markets, usually dominated by NOCs. These differences between firms are also not adequately explained by the theoretical constructs of the framework proposed in Chapter 3.

The argument of retaining sufficient refining capacity in Europe, because it is a key factor for the region's energy security, was one that some participants strongly agreed with. However, remaining

vertically integrated downstream in Europe for reasons of the region's energy security, is not something which can be easily connected to the main constructs of TCE or TCR. There are no theoretical predictions explaining it. Of course, such a decision can be part of a firm's specific corporate strategy (if the firm is a NOC for example), but the theoretical framework developed in this thesis cannot adequately justify such a decision.

An argument which raised controversy states that, changes in supply and demand patterns in Europe is a major reason for acquisitions of storage facilities or conversion of refining facilities to storage in the region, to help handle the new commodity flows. There were nevertheless several participants who strongly agreed with it. This argument can be related to the dimension of temporal specificity, as the theory would predict that conducting transactions in the market would be risky if there is a great potential for strategic holdups by a supplier. Such a potential exists in the rapidly changing downstream oil market in Europe, thus the prospect of becoming more vertically integrated with storage assets acquisitions is attractive. Moreover, the high site specificity of these assets strengthens the rationale for more vertical integration. It seems therefore that the theoretical predictions are indeed valid, at least up to a certain extent.

An interesting argument stresses that weak corporate balance sheets and the difficulty to access credit, is a major barrier for investments in the European refining sector. For some participants this was a very true argument, while not so true for others. However, the relation between these financial aspects and investments in the sector is something which cannot be easily connected to the theoretical framework developed in this study, and no predictions from the theory are available. This is a limitation of the framework which should be considered.

A similar inadequacy of the TCE and TCR framework presented in Chapter 3, is revealed in the case of the item which considers that, acquisitions of less profitable downstream assets in Europe are justified for reasons of extended (foreign) policy reach through energy market control. Only a few participants strongly agreed with this argument. It seems that there is no obvious theoretical construct from the framework to be connected to this argument. What can be said is that, making a decision to invest in unprofitable assets purely for (foreign) policy reasons is very company-specific, and it largely depends on what resources a company has or wants to obtain.

The item mentioning that European refineries cannot compete with the new refineries in Asia and Middle East, as the latter are of high complexity and scale, and this works mostly as a driver for upgrading and expansion investments in European refineries, was a rather controversial one. Some participants strongly agreed with it, while others disagreed. This controversy highlights that it is not easy to decide to invest in assets which are so highly physical specific, such as refineries. However, in the presence of such assets, the theory advocates vertical integration (and thus ownership of these assets). This prediction is verified by the strong positive opinion of some participants for this argument, which indicates that it is preferable to invest in some refineries and keep them in the portfolio than sell all of them or close them down.

An argument which was evaluated very positively by certain participants, states that acquisition of midstream fixed logistic assets leads to better and faster exploitation of arbitrage opportunities. This argument is closely related to the notion of temporal specificity, which proposes asset ownership as a way to have a more flexible strategy and avoid strategic holdups by suppliers. Several participants verified the prediction of the theory, as they indeed mentioned that by possessing this type of assets, a

(trading) company can have a more flexible strategy and can be able to exploit more efficiently, arbitrage, trading and contango opportunities.

The previous discussion has been concerned with all the arguments which received a very positive score from at least some of the participants (a +5 or +4 in at least one factor array). Now the focus will switch to how valid are the predictions of the theory with respect to the items which received the lowest scores by the participants (-5 or -4 in at least one factor array).

Strong disagreement by almost all participants was expressed towards the argument that asset-heavy strategies are becoming attractive, because of the rise of financing and transaction costs due to regulatory changes in the banking and derivatives-trading environment. These changes in the banking and financial sector can be considered as increasing the unpredictability of the environment, particularly for traders. Moreover, they could also be considered as a reflection of increased political uncertainty with respect to new regulatory changes in derivatives-trading. The theory would then predict that due to increased uncertainty, firms would prefer to employ hierarchical governance structures and avoid conducting transactions in the market. However, this is not reflected in the participants' viewpoints, as they do not believe that this uncertainty in the environment can lead firms to internalize transactions by acquiring assets. The theoretical predictions are not verified here.

Strong disagreement was also expressed about the argument that a major driver for acquiring downstream assets in Europe, is because it is a good way to help to serve the growing demand for fuels in Asian countries. Due to the high site specificity of downstream assets, the theory would advocate to become more vertically integrated downstream in the region of interest. So acquiring assets and being active in the downstream business in Europe for serving Asian markets, is not what theory would predict, and the disagreement of most participants with this argument verifies this prediction.

The item mentioning that a major reason for acquiring storage facilities or converting refineries to storage in Europe, is compliance with compulsory stock obligations, also received a lot of criticism by most participants. There is in principle low uncertainty concerning CSOs in Europe, which can be translated to low political uncertainty. When political uncertainty is low, the theory predicts that the market governance structure is more efficient, so there is no need to acquire assets for meeting CSOs and internalize this type of transactions.

"The higher freight costs for moving refined products to Europe from outside the region, than the costs for moving crude oil, is a major reason for investments in refineries located in Europe". This is an argument which received strong criticism by some participants. It is also one of the arguments which cannot easily be "connected" to any of the constructs of the theoretical framework presented in Chapter 3, so there are no theoretical predictions about it. Obviously, a limitation of this framework is revealed at this point.

One of the items which made many participants to express their disagreement, states that the growing competition European refiners face from their US counterparts worldwide, works mostly as an incentive for upgrading and expansion investments in European refineries. This form of competition augments the unpredictability of the environment and the uncertainty about future demand volumes for oil fuels, for European refineries. In such a situation, the TCE theory would suggest to become less exposed to the market through vertical integration and to internalize transactions. However, this hypothesis is not supported by the participants, as they consider that European refiners should in

principle divest refining assets due to the burden of the competition and thus become less vertically integrated downstream in Europe.

An argument raising strong disagreement opinions by several participants but also agreement opinions by fewer, considers local opposition as a major barrier for expanding or upgrading refining facilities in Europe. Refineries are highly site specific, which means they are subject to the pressures of local communities and stakeholders. Moreover, there may an increased risk of third-party opportunism (for example by environmental NGOs) when investments in these plants are announced. This risk of opportunism is explicitly acknowledged by the participants who agree with the argument, but not by the ones who disagree with it. The reason is that for the latter, this risk of opportunism is lower now than in the past, and it also highly-dependent on a plant's location. It seems therefore that these participants also identify that such opportunistic behaviors may exist, however, the risk for noticing them is lower nowadays in Europe.

When it comes to the growing competition European refineries face from their Russian counterparts in the European market, most participants disagreed that this works as an incentive for upgrading investments in Europe's refineries. More competition from the Russian refining sector translates to higher demand volume uncertainty for European refiners. In such a case, the theory would advocate an oil firm to remain vertically integrated downstream or to become more vertically integrated downstream. However, this prediction is not verified by most participants, as they believe that this form of competition drives mostly divestments or refineries in Europe, thus making firms less vertically integrated downstream.

An interesting argument stresses that the need to comply with the European environmental legislation (including biofuels mandates), works mostly as an incentive for upgrading investments in refineries. Many participants strongly disagreed with this argument, and even the ones who commented more positive about, they did not do so because they believe that legislation works as an incentive. They believe that legislation just leads to upgrading investments which are necessary for staying in the business, but only up to a certain extent. The argument under discussion here highlights the (1) site-specific nature of refineries in Europe, which are subject to the local environmental legislation, the (2) increased political uncertainty in Europe translated by a changing and increasing environmental legislation, and finally, the (3) high demand volume uncertainty for oil fuels in Europe, due to the increasing use of bio-fuels in the mix. The theory predicts that in the presence of site-specificity and increased political and demand volume uncertainty, firms can execute their transactions more efficiently if they become more vertically integrated. This prediction is partially supported by the participants' opinions, as many of them consider that there is a limit up to which you can remain vertically integrated in the European downstream oil business and keep investing in your assets. After a point, a firm will find it more economic-efficient to disintegrate and to resort to the market for its downstream oil business transactions.

Pessimism was mainly expressed by the participants about the future of the European refining sector, as most of them disagreed with the argument that the current oversupply in the market will end as smaller refineries close, and therefore acquisitions of refineries in Europe can be justified. Although it could be argued that the European refining sector environment is characterized by increased unpredictability, which would normally lead to more vertical integration downstream according to the theory, this is not believed to be the case. Unpredictability is low in the eyes of participants, because they are simply aware that the current oversupply will remain for the foreseeable future. The same stands for the future demand volumes for oil products. When these elements of uncertainty are low,

then the TCE advocates that vertical disintegration and market governance structures are preferable. This is verified by the opinions of participants who do not perceive many incentives for refinery acquisitions in Europe (and so for downstream vertical integration in the region). A last important remark is that, some companies may proceed with acquisitions of refineries in Europe, because they simply perceive a business opportunity that others can't see. Hence, these acquisition decisions are highly dependent as well on corporate-specific strategies.

An argument which raised some controversy considers CSO as a cost for the industry, because it does not allow it to run down its stocks to the lowest level consistent with its operational requirements. What was highlighted from some comments of participants about this argument, is the high site-specificity which accompanies downstream assets. The reason is that since downstream assets and particularly storage facilities and terminals are in a fixed location, they are particularly affected by the CSO rules applying to the country they are positioned. Since these rules differ per country, the impact of CSOs also differs, and these differences have to be taken into account when making investment decisions. However, in principle, it is not believed that CSOs are seriously affecting the downstream oil business in Europe.

A rather controversial argument is that the high taxes on emissions in Europe, is a major driver for divestments of refining assets. This argument again highlights the high site specificity of refineries which are located in Europe and thus are subject to the particular emissions taxation. However, more than this –and some participants' comments also revealed it– it highlights the increased political uncertainty in the region, with respect to future regulations about emissions. The theory predicts that in an environment where assets are highly site-specific and there is increased (political) uncertainty, vertical integration becomes more attractive. This prediction was partly verified by the participants who disagreed with the argument, as they don't perceive that vertical disintegration downstream (through divestments) is an attractive option. There were nevertheless several participants who felt more positive about this argument, which arises some criticism about the validity of the theoretical predictions.

An interesting argument states that a major reason for divesting downstream assets is to boost the stock price and/or increase dividend payments to shareholders. The participants expressed mixed feelings about it in general, but some strongly disagreed. It is not easy to link this argument to any of the theoretical constructs of the framework developed in this research, so no predictions from the theory can be mentioned. What was emphasized by the participants' comments is that divesting downstream assets for this type of financial considerations, is something which really depends on the company type and size (if it has upstream operations for example etc.). Therefore, it can be claimed that this argument can be explained better by a theory which takes into account the specific characteristics of a firm, because TCE and TCR do not compensate for this.

A last argument which received quite low scores from a segment of the participants, states that a major reason for converting unprofitable European refineries to terminals, is reduction of the plants' costs and release of working capital. While refineries are in general highly site specific assets, unprofitable European refineries –put for sale by their owners– are also not attractive to buyers and hence, there is a small-numbers situation which weakens the bargaining position of the asset owners. In these cases, it is not easy to remove such an asset out of the portfolio, and many companies are forced to convert these refineries to terminals. The theory predicts that when assets are highly site specific and there is a small-numbers condition, it is more efficient for a firm to become more vertically integrated. This is not verified by the participants, who consider that these refineries are not generating enough profits and

firms want to reduce their exposure to the volatile downstream business in Europe. Inevitably, they are converting these plants to terminals and become less integrated downstream in Europe.

### *Items which received lower attention from the participants*

So far, the discussion has been revolved around the items which received most of the attention of participants. Nevertheless, it is interesting to cross-check if the arguments of the interviewees about the other items of the Q set verify or falsify the predictions of the theoretical framework.

The first argument to be discussed considers effective tax rates in Europe, as an important driver for divestments in the European downstream oil sector. Participants in principle disagreed with this argument but at the same time they did not consider tax rates as something of importance. The theory predicts that with higher political uncertainty, with respect to tax rates, vertical integration is beneficial for companies. It is not easy to verify or falsify this prediction from the participants' opinions, as it was not clear if they consider that there is increased political uncertainty or not with respect to taxation. However, divestments in the European downstream oil sector are certainly not driven by low levels of this type of uncertainty.

A very interesting argument has it that political pressure by European governments and labor unions on companies, is an important barrier for divestments of their uneconomic or poorly performing assets in Europe. Participants found very difficult to judge this statement on a pan-European level, simply because the situation differs in every country. Their comments about how different is the situation among European states highlights the site-specific nature of downstream assets, as the companies which own these assets are facing different levels of political uncertainty and governmental opportunism risk, across these different countries.

The statement that a major reason for exiting the refining business in Europe is the strong labor laws and high wages raised quite some controversy among participants. Participants who disagreed with this argument, did so because they mainly think that labor costs do not have a major contribution in the total costs of refineries, so they cannot be considered a major reason for noticing refiners exiting the business. However, almost all participants emphasized that labor costs are indeed higher in Europe, than in other parts of the world, and for some of them, these costs play indeed an important role. Their arguments highlight the increased site specificity of assets like refineries, and that their operators have to pay higher costs in Europe than their competitors in Asia for example. However, the theoretical framework used in this research does not offer a good prediction to be "tested" by the participants' opinions for this argument.

For some participants, acquisitions of refineries in Europe are indeed perceived as a good way to secure downstream outlets for own crude oil production and have a more efficient planning of output over time. By becoming more vertically integrated downstream in Europe, companies can minimize the information asymmetries between them and other players in downstream segments of the oil value chain, and they can also protect themselves from a potential situations with small-numbers of buyers for their crude oil. It seems that the theoretical premises about the relation between information asymmetries, small numbers and vertical integration, are verified.

Interesting insights into the suitability of the theory can be also extracted from the participants' comments about the argument that: European refiners should invest more in chemical operations as they will be able to offer a broader slate of products, which can cushion against market-demand swings

for fuel products. Although some participants remained more neutral about this argument, as it is difficult to invest in petrochemicals nowadays due to financial difficulties, there were also other participants who really believe that European refiners should proceed with such investments. In this way, refiners could reduce the demand volume uncertainty which characterizes their business, due to diversification. This is also predicted from the theory which advocates vertical integration (entering in more segments of the oil value chain, such as petrochemicals) is preferable when uncertainty is high. Moreover, refineries and chemicals plants are also very physical specific assets, and again TCE suggests that in the presence of such assets, transactions are conducted more efficiently with a hierarchical form of governance. So, the predictions of the theory are confirmed by the participants who agreed most with this item.

An argument which highlights the increased site specificity of downstream assets states that, a major reason for acquiring refineries and/or storage facilities in Europe is the region's strategic location, which offers global connectivity and increased trading potential. The comments of participants who agreed with the argument highlight the site-specific nature of these assets. For example, they mentioned that Europe is still a big market with good global connectivity and if a company wants to serve this market or other markets worldwide, it should have a presence in Europe, which in turn requires becoming more vertically integrated downstream in the region. This is what the theory would also predict in the presence of high site specificity. On the other hand, the participants who disagreed with the argument, did so because they think that since there is a fast-growing demand mainly in Asia, it is better to become more vertically integrated downstream there, and not in Europe. This again verifies the site specific nature of downstream assets and the theory premises about vertical integration.

An argument which did not draw a lot of attention by the participants, stresses that the declining North Sea production and Urals availability, combined with increased future availability of other crude blends, is a good reason to invest in changing the European refineries configuration. Although it is evident that refineries are highly physical-specific assets, because they can process only certain types of crude oil qualities, it is not clear if this specificity is so high as to drive companies to remain vertically integrated downstream in Europe (through investments in their plants) or to disintegrate by divesting these assets. Furthermore, it is not clear if the unpredictability of the environment, due to these changes in crude oil supply patterns, is high enough to seriously affect companies' decisions for investments or divestments downstream in Europe. There are mixed feelings by the participants about this argument and it is not easy to test the predictions of the theory.

Participants remained neutral or agreed slightly with the argument that a major driver for acquiring refineries in Europe, is that you can gain a foothold in the region without having to invest huge capital, as many refineries are for sale at favorable prices. If a firm wants to have a presence in the refining business in Europe of course it has to invest in such assets in the region, considering also their site-specific nature. However, investing in unprofitable refineries, not merely because there is a business opportunity, but because there are also other strategic considerations, is not something which can be easily explained by the constructs of the theoretical framework developed in this thesis. The reason is that such decisions for investments are highly dependent on the specific nature and resources of a company (if it is a NOC, from which country etc.), and TCE or TCR do not take into account these characteristics.

An argument which did not receive a lot of support from the participants, states that a major reason for acquiring European refineries and converting them to storage facilities for trading purposes, is that an established site simplifies compliance with environmental regulations. From the comments of

participants who agreed with this argument, it seems that because there is some political uncertainty in Europe (with respect to the strict environmental regulations) and a risk of opportunism from third-parties such as environmental agencies, maybe it is preferable to convert an existing facility to storage than to build a new one. However, new storage facilities have been built over the past years in Europe, so the third-party opportunism risk and the political uncertainty, have not played an important role for these conversions.

When it comes to consider whether investments in the European refining sector are important for job creation purposes, there was neutrality expressed by the participants. What can be identified from some of their comments is that the refining sector is not really labor-intensive, so investments that aim to create more jobs are likely to be done for political reasons. Moreover, the proclivity of firms to invest in European refineries for job-creation purposes largely depends on the specific firm (if it is a “National Champion” or if the government is a shareholder etc.). However, the theoretical framework used in this research does not offer any constructs, to be associated with this kind of idiosyncratic nature of firms involved in the business.

Some participants expressed strong disagreement with the argument that the ownership of midstream physical assets in Europe and the creation of end-to-end supply chains, open opportunities to gain access to exclusive and unpublished market information. Their disagreement was mostly based on the fact that the market is so transparent today that you don’t need to own assets in order to have access to market information; renting such assets can be equally effective. The argument discussed here was more valid in the past years but not anymore. In the past, by becoming more vertically integrated downstream (with asset acquisitions and creation of end-to-end supply chains), a company could decrease any information asymmetries burden, as the TCE theory would also predict. However, nowadays the information asymmetries have been decreased so much, that there is no compelling reason to be more vertically integrated downstream because of them.

The increasing activity from independent retailers/distributors and hypermarkets is not believed, according to several participants, to be a major reason for acquiring storage facilities or converting refining facilities to storage in Europe. The theoretical framework presented in Chapter 3 does not easily help to explain how acquisitions of storage facilities or conversions of refineries can be related to the increased presence of independent retailers and hypermarkets. It can be said that whether a firm would proceed with investment decisions due to this activity, it really depends on the firms’ specific strategy and its capabilities or resources.

An argument which received weak criticism by almost all participants states that, an important reason for investing in the European downstream sector is risk and overheads spreading, as well as hedging against currency fluctuations. From the participants’ comments it seems that there are various reasons why they disagree with this argument, and it seems that whether this proposition is right or wrong, really depends on the company which is supposed to make these investments. It depends on the company’s business model (if it is trading firm) and resources (if it can adequately hedge in the financial market). The TCE and TCR theories do not provide any construct that can explain how the aforementioned, firm-specific characteristics, can affect a firm’s investment decisions in the European downstream oil sector environment.

The participants were asked to assess whether the JVs of oil companies in the refining sector of non-European countries, help them shut refinery capacity in Europe and supply their wholesale and retail European networks with products from these countries. They mostly disagreed with this argument

because they do not perceive the creation of JVs outside of Europe as the main reason for shutting refineries in Europe, or as a necessary precondition for supplying their European retail networks with fuels. However, they acknowledge that there is some truth in this argument, but the decision to become more vertically integrated downstream abroad and less integrated in Europe depends on the capabilities of every firm. Some firms may be able to do it or may not. The theories used in this research do not provide any construct that takes into account these differences in capabilities of firms involved in the European downstream oil business. Thus, no theoretical premises can be tested at this point.

Several positive and negative opinions were expressed by the participants, with respect to the item which argues that asset light strategies are preferred in Western Europe, due to the region's liquidity in petroleum products, good infrastructure, low refining margins and inadequate raw materials base. From the comments of participants who agree with this argument, it seems vertical disintegration downstream in Europe (by divesting assets) is the consequence of low unpredictability of the environment and of low demand volume uncertainty (since demand will keep declining). This is also what the TCE theory would predict. On the other hand, from the comments of participants who disagree with the argument, it seems that they still consider downstream vertical integration (via asset ownership) as important in Europe, because of the increased site-specificity of downstream assets. Again, this is what TCE would advocate.

An interesting proposition which can easily be connected to the construct of small-numbers, states that the emergence of numerous traders, who have facilitated a liquid and competitive market for crude oil and refined products, makes downstream vertical disintegration attractive for oil companies. In other words, the emergence of numerous traders has diminished the potential for situations of small-numbers of suppliers or buyers, and this makes downstream vertical disintegration an attractive option. Many participants remained a bit neutral or slightly agreed with this argument, and from their comments it seems that the theoretical prediction is (weakly) confirmed.

A proposition which cannot be easily connected to any of the constructs of the theoretical framework presented in Chapter 3, has it that a major reason for acquiring assets in the European downstream oil sector, is for accessing new skills and capabilities in specific businesses within the oil value chain, for example oil products marketing. Most participants disagreed that firms would acquire assets in Europe for such a reason. However, others emphasized that this rationale exists, particularly in some Asian companies. Acquiring downstream assets and thus, becoming more vertically integrated downstream for accessing new skills and capabilities, is not something which TCE or TCR theories can easily explain. Such a decision is dependent on a firm's current capabilities and resources, and on which are its goals for its future capabilities and resources. TCE and TCR do not take into account these considerations.

### *Concluding remarks*

The previous discussion highlights some noteworthy remarks. First of all, the theoretical framework developed in Chapter 3 offers constructs which are indeed valid and suitable, as far as investments in the European downstream sector are concerned. The predictions of the theory were in several cases confirmed by the participants, and this is why it is believed that the combination of TCE and TCR offers a successful theoretical framework for the purposes of this thesis research. So, it can be safely said that the framework proposed in Chapter 3, helps to give a satisfactory answer to the first research sub-question (see paragraph [3.7](#)). Moreover, it seems that the choices to include and exclude some of the

different dimensions of the constructs offered by TCE, during the framework formulation, were also correct.

With respect to the asset specificity construct and vertical integration, the usefulness and suitability of notions such as site and physical asset specificity, are obvious from the increased number these constructs were referred to in the aforementioned item-by-item discussion. The issue of temporal specificity is also present, but as it was shown, it is usually related to investments or divestments in storage facilities or terminals. It is thus an issue which mainly concerns trading companies and terminal operators. Moreover, it does not seem from the participants' comments and the results of the Q methodology research, that there should have been an inclusion of any other dimensions of asset specificity in the framework.

The second main construct of TCE is uncertainty and in this case, the unpredictability of the environment and the demand volume uncertainty notions, are more than present in the quantitative and qualitative information extracted from the participants during the interviews. Furthermore, decisions for more or less vertical integration downstream in Europe could often be associated with the issue of political uncertainty, according to the comments of the participants. Therefore, it seems that the choice to retain these three elements of uncertainty and exclude others, like technological uncertainty for example, was also correct.

More skepticism comes in the picture about the usefulness of the small-numbers and the information asymmetries constructs, and this is because there are not many cases where these two theoretical notions can be "identified" in the Q methodology results and comments of participants. This is particularly the case for the information asymmetry construct. Nevertheless, the predictions of these constructs with respect to investments in the European downstream oil sector and downstream vertical integration, were often confirmed (especially the theoretical premises for small-numbers situations). This means that some small-numbers situations and information asymmetries are indeed present, and they can indeed help explain part of the nature of the European downstream oil sector. However, these are definitely less useful constructs when compared to asset specificity and uncertainty.

A last comment should be made as well for the usefulness of TCR. TCR does not provide theoretical constructs which can explain the logic behind decisions for investments or divestments and for more or less vertical integration. The reason is simply because this theory is concerned more with the types of opportunism that may emerge when public-private party transactions take place. In that sense, it was not expected to find a lot of information in the participants' comments and in the results of the Q methodology research that could be connected to TCR, simply because this information indicates mainly the rationale for investments in the European downstream oil sector. However, the arguments of participants helped to reveal, in some cases, that there is indeed a risk for governmental or third-party opportunism in the sector. This risk may affect investment or divestment decisions of firms in the business. In other cases, acknowledgment of this type of risk is implicit in the comments of participants. Conclusively, it is believed that it was a correct decision to take into account the TCR theory for the development of the theoretical framework. The rightness of the choice to integrate TCE and TCR for the creation of this framework was verified from the results of the Q methodology research.

Nevertheless, there were also cases where the predictions of the theory were not verified by the Q methodology results and the comments of participants. This may be attributed to the high complexity of the investment environment of the European downstream oil sector. In other words, the high specificity of downstream assets, the uncertainty, the small-numbers situations and the information asymmetries

in the business, are not “isolated” from each other but they work in combinations and may affect investment or divestment decision of firms involved in the business. Their combined effect makes it, in cases, difficult to explain the desires of firms to become more or less integrated downstream in Europe. For example, in a situation where there are highly specific assets but low uncertainty, it is not so easy to assess whether a firm may find more efficient to execute transactions in the marketplace (so it will divest downstream assets – lower vertical integration) or internally (so it will invest in downstream assets – higher vertical integration). This confusion may be the reason why in some cases the theoretical predictions were not fully confirmed.

Last but not least, it was revealed in certain occasions (of items discussed previously), some inadequacy of the TCE and TCR framework to explain certain investment or divestment decisions of firms involved in the European downstream oil sector. What is common in almost all of these cases is a lack of focus, from the theoretical framework, on the specific characteristics of an individual company, on its strengths and weaknesses, on its capabilities and resources etc. There are firms of different size and scope, which take investment decisions and are becoming more or less vertically integrated downstream in Europe, in completely different ways. It seems, therefore, that a theoretical element is missing from the framework developed in Chapter 3 of this report; an element which takes into account the idiosyncratic nature of firms. Maybe this element can stem from the resource-based view theory which, as part of a future research attempt, can complement the framework proposed here and compensate for its limitations.

## 6. Conclusions and Limitations

This Chapter will present the concluding remarks of this research project, along with its limitations. These will be accompanied by a discussion about the academic contribution of this thesis and its practical relevance.

### 6.1 Conclusions

This thesis research aimed to understand more about the rationale behind corporate decisions to invest or divest in the European downstream oil sector.

As it was described in Chapter 2 of this report, the European downstream oil sector is experiencing tremendous pressures and there are several dynamics currently affecting the business in Europe. The key players, the companies themselves, respond differently to these dynamics. Some are proceeding with divestments whereas others are investing in their assets. Moreover, new entrants have been appearing, interested to fill in the gap which is left mainly from the exiting IOCs. The market has also seen trading firms getting involved in refining and vice versa. In the end, although it is possible to observe how different firms react with regards to investments or divestments, it is not so obvious why they react in these ways and often take completely contradictory investment decisions. This is exactly what this thesis research aimed to discover and consequently, its main research question was formulated as follows:

*“Which are the most important drivers behind corporate decisions for investments or divestments in the European downstream oil sector?”*

This research question could not be answered correctly by merely trying to identify in the literature these drivers, and a more systematic approach was required. This comprises the use of an appropriate theory to help describing the unique nature of this sector and of the factors driving investments or divestments decisions. Furthermore, identifying the most important drivers is not so straightforward, as an important driver for investments for one stakeholder in the business, can be an important driver for divestments for another stakeholder or an unimportant driver altogether. There are differences in how stakeholders perceive the same drivers, so it was necessary not only to identify drivers for investments or divestments, but also to have them evaluated by the stakeholders themselves. This is one of the main reasons the Q methodology research technique was employed, as it allows for an evaluation of these drivers according to the stakeholders' point of view.

#### *First research sub-question*

Among all the potential theoretical frameworks that could be used to serve the purpose of describing the attributes of the European downstream oil sector, the Transaction Cost Economics (TCE) was chosen. The TCE theory seemed to offer an appropriate framework to help describing the nature of the European downstream oil sector, based also on the observations in the previous work of Meijknecht, Correljé, & van Holk (2012). However, some limitations of TCE required considering other theories which could be used in a complementary way to TCE, and eventually allow for the creation of a new theoretical framework suitable to describe the idiosyncratic characteristics of the European downstream oil sector. In the end, Transaction Costs Regulation (TCR) was chosen to be integrated with

TCE. These considerations led to the need to answer the first research sub-question before continuing with the rest of the research, which is the following:

*“How well can a combination of TCE and Spiller’s TCR theoretical framework describe the unique characteristics of the European downstream oil sector and help research in a systematic manner the drivers behind corporate decisions for investments or divestments in this sector?”*

This question was answered adequately in Chapter 3 and Chapter 5 of this report. TCE offers a wide range of theoretical constructs to be used, such as asset specificity, uncertainty, transaction frequency, information asymmetry, small-numbers issues and governance structures. These constructs were all discussed in detail, along with the specific elements from which they are comprised. It was argued that not all of them are useful or suitable for describing the European downstream oil sector. Specific dimensions of asset specificity and uncertainty were discarded from the analysis, along with the construct of transaction frequency itself. In the end, only the useful parts of the TCE theory were retained; the ones that could be used for describing the unique nature of the European downstream oil sector and of the transactions taking place in it. However, as it was argued, TCE alone is not enough for this purpose as it is mainly concerned with costs of transactions due to opportunistic behavior of private parties. This is not the reality in the downstream oil business, as the active presence of public parties, either directly as shareholders in companies or indirectly as regulators, changes completely the landscape. New risks emerge because of the potential opportunistic behavior of governments or other third-parties. TCR takes into account these risks and this is why it was used as a complementary theory to TCE. It was sufficiently discussed how the constructs of TCR are suitable for describing these new kinds or risks and it was argued that this theory, when combined with the TCE, is useful for depicting some of the characteristics of the downstream oil business in Europe. The ultimate result of this process was to integrate both theories and suggest a new theoretical framework, specifically meant to describe the attributes of the European downstream oil sector and of the investments taking place in this business. This theoretical framework is presented at paragraph 3.7 - Figure 13. In the end, the framework was tested against the results of the Q methodology research in paragraph 5.4.6, where it was shown that it is capable to explain a large part of the rationale behind corporate decisions for investments or divestments in the European downstream oil sector. The few limitations it has can be addressed by complementing the framework with theories like the resource-based view, as proposed already in Chapter 5.

### **Second research sub-question**

After ensuring that there is an adequate theoretical background which, through its constructs, can provide the directions for researching the drivers behind corporate investment or divestment decisions, the second research sub-question of this thesis had to be answered:

*“Which are the most important drivers behind investment or divestment decisions of companies involved in the European downstream oil sector that can be identified in the literature?”*

The way this research sub-question was answered is as follows: an extensive literature review resulted in a collection of 384 statements or otherwise called items, which all highlight, explicitly or implicitly, reasons for proceeding with all types of investments or divestments in the European downstream oil sector. Researching and identifying all of these drivers was also the first step of conducting the Q methodology research, which was to define the concourse. Then, in order to develop the Q set from the initial list of items, two refinement rounds were performed; in the first one, all the items of the initial

list were clustered under categories related to the constructs of the theoretical framework developed with the combination of TCE and TCR. The five categories were (1) asset specificity, (2) uncertainty, (3) information asymmetry, (4) small-numbers and (5) corporate strategy. Subsequently, the number of items was reduced by cross-checking for replications and redundancies between items, while whenever necessary, rephrasing was conducted in order to create some “super items”. In this way the 384 initial items resulted in 83 new items, which however had to be further reduced to a smaller number. A second round of refinement followed, again with the same approach of positioning the items under categories. These categories were referring to specific issues such as (1) external competition & shifts in global markets, (2) European policies, (3) national & local level issues, (4) capacity & technology issues, (5) upstream operations & crude oil supply issues, (6) financial issues, (7) investments in midstream assets & refinery conversions and last but not least, (8) firm specific strategies. All 83 items were clustered according to their relation to one of these topics and by following the same steps as in the first refinement round, it was achieved to decrease their number to 42 final items. At the end of every refinement round, the newly-generated items were presented in front of experts in the topic of this research, from TU Delft. This allowed for cross-checking and ensuring the quality of the final 42 items of the Q set. This sum of 42 items is both the Q set which was later used in the Q methodology research, and the answer to the second research sub-question of this research. These 42 items can be found in paragraph [4.1.3](#) of this report.

### *Third research sub-question*

At this point, the main drivers for investments or divestments in the European downstream oil sector, reflected in each one of the 42 items of the Q set, had to be evaluated by the stakeholders in the sector. This would eventually reveal which of them are indeed valid drivers and also what is their relative importance. In other words, the following research sub-question had to be answered:

*“How do different stakeholders in the European downstream oil sector perceive the aforementioned drivers in terms of validity and importance?”*

This question was answered with the Q methodology interview sessions with 13 participants (stakeholders) related to ExxonMobil, Shell, BP, Q8, Vesta Terminals, Hestya, COVA, FuelsEurope, CIEP, a Consultancy Firm, the Dutch Ministry of Economic Affairs, the European Commission and TU Delft. Participants were asked to create their own Q sorts by positioning the 42 items, printed on small cards, under a relative scale expressing level of agreement. Furthermore, during the interviews, participants were asked specific questions in order to provide some qualitative information about which are in their point of view the most or least important drivers for corporate investments or divestments in the European downstream oil sector. The 13 Q sorts were collected and with the help of statistical analysis conducted with the PQMethod software, it was possible to identify similarities and differences among the participants’ answers. The results extracted revealed three Factors which represent three different points of view with respect to the drivers for investments or divestments represented in the Q set. These three Factors were discussed in Chapter 5 - paragraph [5.1](#) and it was also shown whom of the participants shared similar ideas with others or not (paragraph [5.2](#)). Subsequently, the qualitative information from the interviews was used in the discussion part of this report, in order to present the different points of view of participants, towards each one of the items of the Q set. This entire process gave a comprehensive overview of the argumentation behind participants’ opinions about specific drivers for corporate investments or divestments in the European downstream oil sector. The discussion about all the items for which there was consensus and agreement, consensus and

disagreement and controversy among participants, actually consists the answer to the third research sub-question of this thesis.

In the end, 25 key drivers for corporate investments or divestments were deducted and presented in Table 7, which was followed by a brief discussion about each one of them. This collection of drivers, in combination with particularly the qualitative information provided in paragraph 5.4.4, offer the final answer to the main research question of this thesis project. As it was expected, there is indeed increased diversity among stakeholders' viewpoints towards the issue of what is driving firms to invest or divest in the downstream oil business in Europe. Even in cases where stakeholders belong in a similar background, the differences among their opinions are quite substantial and it is also noteworthy that none of the three Factors extracted exemplifies the point of view of a particular group of "similar" stakeholders. The issue of improving the competitiveness of, especially, the European refining sector is a very complex one and it can be solved only with policies which are taking into account this diversity among opinions.

## 6.2 Limitations

As all types of research, this one also has its limitations. Although it is believed that these limitations do not invalidate the findings of the research, they have nevertheless to be taken into account. After all, limitations can always be used as the starting point for further research and this case is not an exception.

- The first limitation has to do with the theoretical part of this research and with the theoretical frameworks used to describe the nature of the European downstream oil sector. In this thesis project, a combination of the TCE and TCR theories was used to the aforementioned end. However, it is certain that these are not the only suitable theories to be used for a similar purpose. In paragraph 1.6 it was discussed why Porter's famous five forces model is not so appropriate for describing the characteristics of a market with so many imperfections, such as the downstream oil market. However, since it was out of the scope of this thesis, it was not examined how well other theoretical frameworks, like for example the resource-based view theory can be used for highlighting the attributes of the (European) downstream oil sector. This became more obvious after discussing about the predictive strength of the TCE/TCR framework is paragraph 5.4.6. TCE and TCR theories can definitely serve the purpose of this thesis project but they also have some limitations and they should not be considered as the "holy grail", because other theories in the literature may be also very well-fitting.
- The second limitation has been introduced in Chapter 4, and it concerns the background of participants. It is true that although in a Q methodology research there is no need to have a large sample, it is nevertheless important to have a well-balanced sample. In this research the sample was not perfectly balanced. This inevitably brings in some restrictions concerning the results, because the topic of drivers for corporate investments or divestments in the European downstream oil sector is a very complex one, and there is a wide spectrum of opinions and viewpoints of stakeholders involved. So the more participants with different backgrounds involved in the research, the more of this diversity among opinions can be taken into account. Hence, it is believed that there may be different points of view of stakeholders involved in the business, which could not be taken into consideration as time and geographical restrictions did not allow for a larger sample of participants and more precisely, for a better-balanced sample. Of course, the effort was made to have the greatest possible variety of participants' profiles, but

still, there are certain groups of stakeholders who are represented more than others. The most characteristic example is that there are 3 participants related to IOCs in a sample of 13, while there is only one participant related to a non-European NOC, and none participants related to European NOCs or independent refiners. This underrepresentation of participants “stemming” from specific groups of stakeholders undoubtedly introduces some bias in the final results of the Q methodology research. Nevertheless, the author of this thesis is aware of this bias and this is why no attempt was made to relate any of the three Factors extracted, to a specific group of stakeholders. It is expected that with more participants with different profiles involved, the results may have been altered to a certain extent.

- A third limitation comes in the general picture due to the bias introduced by the author of the thesis during the lengthy process of reviewing the literature for identifying drivers for investments or divestments in the European downstream oil sector. The same stands for the process of formulating the Q set with 42 items instead of the initial 384. Concerning the literature review, there was an effort to minimize bias in items selection from various sources, by expanding the review in both academic and non-academic sources. Moreover, there was a general appetite for including more items in the initial list, than for disregarding them, with the purpose of taking as much of the diversity in statements/opinions that could be found in the literature as possible. Despite of these efforts though, there were still some considerations about drivers for investments or divestments in the European downstream oil sector, which were not identified from the author of this thesis. These “extra” considerations were presented in paragraph 5.4.5. Nevertheless, considering the positive feedback from almost all participants with respect to the arguments presented in the 42 items of the Q set, it is reasonable to believe that the bias due to the missing considerations was subtle. Concerning the formulation of the Q set and the refinement of the initial list with 384 items to the final 42, of course there was certain bias introduced due to the choices of the thesis author to merge, rephrase and exclude some items. Despite of the careful selection of which items would be retained, this kind of bias will be inevitably introduced in a Q methodology research, particularly considering that the only person who actively researched for and generated the Q set items, was the author of this thesis. If more researchers would be included in this process, this bias would be minimized. However, it is believed that due to the systematic procedure which was used to formulate the Q set, by clustering the items first with the use of theoretical constructs and then according to the nature of the driver they are discussing about, the researcher bias did not pose a serious problem. More details about this issue are also presented in paragraph 7.2 of Chapter 7.
- A last limitation is related to the simple fact that there is some bias introduced by the author of this thesis during the phase of interpretation and analysis of results. It is reasonable to expect that the researcher is always influenced to a certain extent by the specific literature he or she has focused on and by his or her own ideas, and this may be reflected in the interpretation of the research results. Furthermore, in the case of this thesis, the researcher had personal discussions with the respondents and it is likely that certain information emphasized by the latter, draw the attention of the former, which eventually may have influenced to a, hopefully, limited extent the analysis of the research results.

### 6.3 Scientific relevance

The research conducted is part of a Master thesis project, so it is important to mention in which ways this research is contributing to the general body of academic knowledge. This contribution is twofold, as the thesis research has focused on two main issues. The first was to use the TCE theory and to

integrate it with the TCR theory, in order to create a theoretical framework capable of describing the characteristics of the European downstream oil sector. The second issue was to use the Q methodology research technique in order to discover more about the drivers identified from the literature and derive useful conclusions about how the different stakeholders in the sector perceive them.

Concerning the first issue, it was thoroughly explained how and why the TCE theory is suitable for the purpose of this thesis research. Moreover, the limitations of TCE when it comes to describe the attributes of the European downstream oil sector were discussed, as well as how these limitations indicated that TCR theory could become a useful complement to TCE. All the main constructs of the theory were presented and discussed in Chapter 3, while the second step was to critically evaluate their usefulness within the context of this research. Eventually, choices were made to retain some of the TCE constructs and to discard others, from the rest of the analysis. Moreover, an attempt to combine TCE and TCR was made, which resulted in a new theoretical framework suitable for describing specifically the nature of the European downstream oil sector. It is noteworthy that in this thesis, a modification of a theory like TCE took place and then this was integrated with TCR, after proving that the latter can be used for describing the downstream oil sector, apart from the utilities sector. This framework could be also used to analyze other industries similar to the downstream oil industry, where substantial interactions are taking place between the private and public sector. This new theoretical framework presented in paragraph 3.7, is the first main contribution of this thesis to the scientific world.

The second pillar of the academic contribution of the proposed research project has to do with the use of the Q methodology research technique. This technique has been increasingly gaining ground over the past years and becoming more acknowledged as a tool to identify patterns of similarity or dissimilarity among the perspectives of individuals with respect to a particular topic. Many examples of previous applications of this research technique can be found in research about public policy issues, environmental policies issues, public interest issues, sustainability and health economics issues, other social and political science issues etc. However, there has not been in the past any application of the Q methodology research in the context of the downstream oil industry, at least to the knowledge of the author of this thesis. This thesis project is the first example of how Q methodology can be used for research in relation to the (downstream) oil industry, which is a global industry surrounded with increased complexity. Therefore, this application can be the starting point for using the Q methodology technique in research about similar issues as the ones the European downstream oil sector is facing, in other industries. On top of that, the results of this thesis research and the newly-created knowledge can be very useful for academics who want to further investigate the trends in the European downstream oil sector. It is also remarkable to mention that the application of the Q methodology research technique for the relevant topic might also be an interesting case for social scientists, researching human perceptions of specific facts (drivers) within highly-complex and drastically changing industries or environments. Furthermore, it should not be neglected that this thesis research might turn to be useful for scientists interested in public interest, economics or energy related topics. Conclusively, using the Q research methodology itself for such a topic is a major way this thesis project is contributing to the academic body of knowledge.

Moreover, the fact that Q methodology was used to “test” the predictions of a theory such as TCE, is also a major academic contribution of this thesis. As it will be elaborated in Chapter 7 (Reflection), instead of doing a usual statistical analysis for testing the premises of a theory like TCE, this research indicates maybe the second-best way for exploring and testing such a theory with the use of Q methodology. This is very important in cases of research where there is not a sufficient number of observations available, in order to allow for a statistical analysis. Such is the case of the European downstream oil sector,

where there are not many firms involved in the business, taking investment or divestment decisions. Testing theories in the context of the European downstream oil sector or of other similar sectors (with a few firms involved), may be feasible with the use of the Q methodology.

What is also of high importance is to emphasize that this study highlighted an alternative way of generating the Q set items for a Q methodology research; a way which includes the use of an explicit theoretical framework in connection to the academic and non-academic literature. Unlike the more usual procedure of deriving the Q set items from preliminary interviews with participants or from a mere literature review, where no explicit underlying theories are used in principle, this research showcased how items can be derived by combining a literature review and the use of theory. It is also believed that if a researcher would undertake a similar research and follow the steps for the Q set formulation, as described in paragraph 4.1 of this report, he or she would create a Q set very similar to the one used in this research. Of course, it would be impossible to generate the exact same items but all the major drivers and considerations represented in the Q set of this study, would be represented also in a new Q set derived with the same process. To conclude, the procedure employed for generating the Q set of this study, is by itself a major contribution to the academic world and particularly to the domain of Q methodology research.

#### 6.4 Practical relevance

The usefulness of this thesis project from a societal/practical point of view is quite straightforward, particularly for policy makers in the European Commission or in the European National Governments. Identifying from all different stakeholders involved, what is perceived as a driver for investments or divestments in the European downstream oil sector, and the relative importance these stakeholders attach to these drivers, can drastically facilitate the decision making processes with respect to appropriate policy formulation. The use of the word appropriate here refers to policies which can enhance the competitive position of the European downstream oil sector as a whole. As it was revealed from the research results, there is increased diversity among perceptions of stakeholders about what is driving investments and what is not, and also of what does count more and what does not. Therefore, appropriate policies cannot be and should not be a “one-for-all” solution, but they should take into account this diversity or opinions and consider the different characteristics, investment strategies and capabilities of companies involved in the European downstream oil business. Moreover, the industry itself is structured in a different way in the Northwest, in the Mediterranean and in Central Europe and the risk of political interference varies greatly among countries in these regions. This adds more complexity to the competitive problems the sector is facing, and increases the difficulty of designing and imposing appropriate policies that aim to enhance the sector’s competitiveness. This is of particular importance because inefficient policies may not manage to revive the sector, and this in turn will create greater economic and sociopolitical problems due to job losses and social unrest. Furthermore, it seems that retaining sufficing capacity in Europe still largely perceived as important for the region’s security of supply, so a weak refining sector might create problems of energy security. To conclude, this thesis has offered a comprehensive overview of what is mainly driving the investment or divestment decisions of firms involved in the European downstream oil sector. Hence, the results of this study can become an important tool in the hands of policy makers in Europe, so as to help them better understand the “way the sector thinks”. This in turn will facilitate the formulation of more well-designed policies, which can be implemented effectively and stimulate the sector’s competitive position, which will also lead to welfare maximization for European societies.

However, the practical relevance of this thesis project is not constrained only to policy making purposes, but the results of this study are very useful also for managers of companies involved or planning to be involved in the downstream oil business in Europe. The reason is that the findings of this research help clearing up the fuzzy picture of the incentives behind various corporate strategies with respect to investments or divestments in the European downstream oil sector. Consequently, these results offer a tool for managers in companies to understand what is driving the decisions of other players in the business, who may often be their competitors. Becoming aware of how other firms are thinking in this business, enables a company to re-evaluate its perception of the dynamics in the sector, and maybe adjust its business strategy, if necessary, in order to gain a future competitive advantage or prevent its competitors from gaining it. Additionally, this thesis research was not concerned only with the rationale of the industry side, but it also offered a good insight into what the policy makers think is driving the investments of companies involved in the business. This is very useful information for firms involved in the business that have to cooperate with policy makers and comply with current and future regulations, because it decreases the misunderstandings and the information asymmetries between these two sides of the market. Furthermore, markets analysts and researchers were also interviewed, and they revealed their own understanding about which are the major drivers for investments or divestments in the European downstream oil sector. This offers a “helicopter” point of view which is useful for managers in companies involved in this business because it shows the rationale of someone without a vested interest, who can have more objective judgment about the factors affecting the business.

A last important issue the results of this research have highlighted has to do with how the forces of competition work in an industry such as the European downstream oil one. It is important for both policy-makers and also managers of firms involved in this industry, to realize that the uncompetitive European downstream oil sector is not able to “fix itself” due to competition forces, stemming mainly from other regions of the world. This is what Neoclassical Economics would predict, but this prediction is not verified. This research has revealed that for the sector to become “healthy” again, more actions are necessary than merely relying on the self-correcting forces due to competitive pressures. More precisely, it seems that more interventions are necessary, from both the European Commission and from European National Governments, for restoring the competitiveness of the downstream oil sector. Therefore, a critical factor to determine whether the sector will be strengthened has to do with the appetite of, particularly, the European Commission, to take a leading role in the sector-restructuring effort and develop suitable policies with reasonable objectives. Hence, more political interfering in the European downstream oil market may be inevitable and at the same time necessary, if the sector is to stand back on its feet again.

## 7. Reflection

This report and its conclusions constitute the end-result of a Master thesis research project that started in April 2014. The main goal of this research was to understand more about what is driving the decisions of companies to invest or divest in the European downstream oil sector and what is discussed in this Chapter, is whether the research approach adopted by the author of this report was successful in meeting this goal.

In principle, it is believed that the chosen research design was successful, as the research generated valuable insights into the topics it was aiming to “dive in”. Moreover, all the three research sub-questions were answered adequately, enabling eventually to answer the main research question of this thesis project. However, there were some obstacles encountered, particularly with respect to the Q methodology research. In order to reflect about the whole research process the author will refer to the two main pillars of this project; firstly the use of theoretical frameworks to describe the characteristics of the European downstream oil sector and then the use of the Q methodology technique in order to conduct the “field research” necessary for this study.

Last but not least, since this research project is the last part of a Master of Science in Management of Technology study program, it is important to reflect on the impact of the research results on this domain and on what these results mean to future technology managers.

### 7.1 Application of TCE and TCR theories for describing the European downstream oil sector

There is not much to be discussed about the theoretical frameworks employed for answering the first research sub-question, because it is deemed that the combination of TCE and TCR is indeed an adequate theoretical basis to be used for analyzing the nature of the European downstream oil sector. Following the indication of Meijknecht et al. (2012), TCE theory was used as a promising starting point for this effort and it was proved that the vast majority of the main constructs of this theory are indeed suitable for the purpose of this research. Only a few parts of the theoretical elements offered by TCE were judged to be inappropriate and they were discarded from the analysis. This observation boosted the confidence of the author of this thesis, as it highlighted the suitability of TCE for describing the characteristics of the European downstream oil sector. However, due to its limitations which were acknowledged by the thesis author on an early stage, the idea was to complement it with TCR and propose a new theoretical framework adequate to meet the purpose of this research. It was argued that TCR can be a good match with TCE when the goal is to employ these theories for depicting the specific attributes of a sector similar to the European downstream oil one. This integration process is believed to have led to a successful end-result, which not only offered an appropriate theoretical basis for conducting an analysis of this sector, but it also provided the key constructs that helped researching systematically in the literature, the drivers for corporate investments or divestments in this sector. Furthermore, the theoretical framework was “tested” through the results of the Q methodology and the comments of participants, and it was indeed confirmed to be successful in predicting to a large extent, why firms are investing or divesting in the European downstream oil sector. Of course, it is not perfect, so this is why it was indicated that complementing it with a theory, such as the resource-based view, may compensate for its few limitations.

## 7.2 Use of Q methodology research technique

The author of this thesis based his decision to use the Q methodology research technique on the reasons explained in Chapter 1. It is believed that Q methodology has served well the needs of this thesis research, considering the diversity among participants' opinions on what is driving investments or divestments in the European downstream oil sector. This technique has helped revealing this diversity and emphasizing on what counts more as a driver for investments or divestments, according to the point of view of the stakeholders in the sector. There were nevertheless two main hurdles the author of this thesis faced while conducting this research.

The first was the time required for the formulation of the Q set. The process of conducting an extensive literature review for the identification of items referring to investments or divestments, refining these items and concluding the final Q set, required almost twice the time it was projected initially by the author of this thesis. This was a good lesson learned and considering that a thesis project usually is supposed to last for 6-9 months in total, it is advisable for students-researchers willing to undertake a Q methodology research, to devote a serious amount of time in their planning for the Q set formulation. Nevertheless, in the case of this research, the end result (Q set) of this lengthy process is believed to be very good, considering the comments of participants which will be referred in a subsequent paragraph.

The second serious problem was that it turned out to be very difficult to "recruit" more participants, particularly related to NOCs, independent refiners etc. As it was discussed in the limitations of this study, although the 13 participants of the sample do allow for drawing useful conclusions, the imperfectly-balanced sample limits to a certain extent the results of the research. It was very difficult to find more people to be involved, particularly within the time-frame of a Master thesis project. Next to this is the fact that in order for a person to be eligible for this research, he or she needed to have a necessary profile; so for example people merely working for an oil company would not be good candidates unless they had knowledge about the downstream oil business in Europe. This constraint limited the recruitment options even more. On top of these considerations is the fact that it was necessary to conduct the interviews with the participants in person and not via phone or other internet means. This limited even further the number of suitable candidates as physical proximity with them was required. It should be acknowledged that data collection in a Q methodology research can be conducted also by distance, as there are certain dedicated Internet websites where a researcher can design a Q set and a participant can create a Q sort. However, usually it is advisable to conduct the interviews in person (Watts & Stenner, 2012), as this is perceived as more efficient for informing the participants correctly about how to proceed with the sorting and for extracting qualitative information from the discussion with them.

Despite of the aforementioned problems, it turned out that the Q methodology research was in principle well-designed and this was confirmed by the positive feelings of participants during the interview sessions. A lot of attention has been paid to the formulation of the Q set items and a large amount of time was dedicated to this end. As explained in details in paragraph [4.1](#), these items have been derived from a systematic process which includes the extensive use of high-quality literature sources, the use of suitable and well-acknowledged theoretical frameworks (TCE and TCR) and finally, the use of interviews with experts on the topic for reasons of items validity verification. All these considerations should make clear that the Q set items are of high quality and are indeed valid. The conviction of the author of this thesis about the high quality of the Q set was also verified by almost all participants, who gave a very positive feedback with respect to the Q set items. From their comments it was shown that

they considered the Q set items covering a serious number of issues the European downstream sector faces, while also demonstrating an adequate depth. The participants' positive opinion is also highlighted from the fact that, in most cases, they could not easily mention an important issue, in their perception, not reflected in the items of the Q set. Furthermore, it was mentioned that the wording used in the items required from participants to think carefully about an item and make a judgment, which was not an easy task. However, in the end, this wording facilitated the participants' decision making as it "forced" them to distinguish the items which they agreed more with, and this was evaluated positively by the participants. A comment that should be made however is that despite of the issues discussed previously in this paragraph, the author of this thesis is aware that the Q set generated for this research is not perfect. As it was explained in the limitations of this research, it could never be perfect by having only one researcher trying to generate the items about such a complex topic, out of 384 initial items found in the literature. The reason is simply the limited cognitive capacity of individuals and fact that there was only one perspective in this process; the perspective of the author of the thesis. A solution that could then improve even more the quality of the Q set, would be to include more researchers in the process (so also more perspectives), preferably experts on the topic. That would increase further the reliability of the study. Nevertheless, this is something that was not feasible in the context of this research, as this is part of the thesis project of the author of this report and so it was an individual work.

It is very important to mention that in the case of this research, there is an application of the Q methodology technique which, among other things, helps to test the theoretical predictions of (mainly) TCE. This was discussed in paragraph [5.4.6](#) and it was shown how that Q methodology offers an alternative way to evaluate whether the premises of theory hold true. The most usual method to test a theory such as TCE, is by using statistical analysis tools. However, in the case of this research, exploring why companies are investing and divesting in the European downstream oil sector, and trying to connect these decisions to predictions of the theory by means of a statistical analysis is not possible. A lot of observations are needed for a meaningful statistical analysis, however there is only a small number of firms involved in the Europe downstream oil sector. This in turn does not provide a sufficient number of observations, inhibiting any research with statistical tools. Therefore Q methodology may be a promising way to overcome this obstacle. Next to this, using statistical tools offers insights by observing externally an industry/firm etc., but it does not give the "inside view" of the stakeholders involved in the industry/firm. Q methodology does this and hence, it offers the extra information required to make a superior analysis and extract more and/or better conclusions.

Concerning the interview sessions with the participants, it is interesting to mention that in principle they expressed their positive feelings about these sessions. The main reason is that these interview sessions were not concerned with a typical Q&A setup but with the interesting task of having to sort the Q set items. Consequently, participants mentioned that they were intrigued by the sessions and expressed their curiosity about how Q methodology works, how information can be processed and how results can be extracted.

The interview sessions were very interesting for the author of this thesis as well. It was very insightful to observe the participants' reactions to particular items and listen to their comments, particularly for items which they had difficulty in deciding how much they agreed with. Next to this, the open questions asked to the participants after the sorting were offering the freedom to make a useful dialogue with them, and to understand more about their perceptions with respect to the drivers for investments or divestments in the European (and not only) downstream oil sector.

From all the aforementioned, it seems that employing Q methodology research technique proved to be a right choice. This technique helped to reveal in a pleasant way, for both the interviewer and the interviewees, much of the latter's opinions about what drives investments or divestments in the sector and what is of higher priority for them. Considering the variety of different dynamics the sector is facing, it is believed that presenting in front of participants a Q set with items covering a wide range of this variety and asking from them to rank these items according to their agreement or disagreement, offered much more information than what simple Q&A interviews would offer. If participants would be simply asked in the form of open questions, to give their opinion about what drives corporate investments or divestments in the sector, it is likely that this would be problematic. The reasons for this are that it would be more impractical (in terms of time) and maybe unfeasible in some cases, because a participant would have to think all of these issues on his or her own, instead of having them collected and presented in front of him or her. Moreover, this would not offer a more holistic picture about which are the important or unimportant drivers for investments or divestments, as participants would be inclined to focus only on what is important in their opinion, not on what is not important. This in turn would introduce serious bias in the answers and it would offer less information to be extracted. Last but not least, in this case it is likely that the interpretation of the participants' answers would be more difficult or in other words, it would be more difficult to extract meaningful results, as each one of the participants would be focusing on different aspects of importance in his or her opinion. To conclude, the author of this thesis feels that the Q methodology research technique gave satisfactory results and helped to avoid obstacles which would be raised if typical Q&A interview sessions would be employed. Indeed, it seems that Q methodology research technique is very useful for exploratory research where the topic is very complex and the perceptions of people about it differ greatly.

### 7.3 Impact of this research on the domain of Management of Technology (MoT)

A remark should be made at this point about the important contributions of this research to the MoT domain. To start with, by attending courses like Economic Foundations, Corporate Finance, Technology and Strategy, Inter- and Intra-organizational Decision-Making, and Technology Dynamics, within the frame of the MoT MSc programme at TU Delft, the author of this thesis was in position to better understand the nature of this research and of the European downstream oil sector. At the same time, the results of this thesis are contributing to all of these five domains.

Vital elements of the MoT field are concerned with corporate strategy formulation and decision making processes within a technology-intensive environment. This research has a strong focus on both of these two elements, as it is heavily concerned with the strategies of firms involved in the European downstream oil sector, as well as with the rationale behind their decision making with respect to investments or divestments in the sector. This is important, because although the downstream oil sector is certainly not high-tech, it still remains a sector of strategic importance for the European economy. Next to this, economic theories play a crucial role within MoT and this research takes this into consideration, as it attempts to discover these drivers based mainly on the widely accepted economic theory of TCE. Additionally, this thesis has revealed some of the effects of regulation on the European downstream oil sector. This is closely related to the domain of Technology Dynamics, where there is a strong focus on understanding how regulations can contribute or hamper the diffusion of technologies. For example, it is clear that the environmental legislation of the EC, is definitely paving the way for the adoption of more innovative and environmental-friendly technologies in the downstream oil industry.

The most important lesson this research can offer to technology managers, is that in complex environments with a multi-actor context, such as the one of the European downstream oil sector, investment strategies of technology-intensive firms are often not straightforward. As a matter of fact, decision making for investments or divestments in new technologies/projects in such an industry, is greatly affected not only by the actions of competitors and by a firm's resources (capital, technology, human etc.), but also by the activities of other political institutions present in the external environment. So it should be made clear that the market certainly does not work in isolation and that there is a blurred line dividing the industry and the policy-making side. Managers of technology in firms have to bear this in mind, and eventually have to start thinking both as corporate managers and as policy-makers, in order to become adept at formulating more effective strategies. Moreover, the great diversity of perspectives among stakeholders about the same issues, highlights that managers of technology should be ready to think outside of a specific company boundaries, and adopt a much broader perspective.

Concerning the use of Q methodology, this research has showcased how this technique can be employed by managers of technology who want to discover more about the different viewpoints of stakeholders in complex industry environments. Q methodology can help not only to discover what is important for all the other actors, but also what is considered not important or not valid.

## 8. Recommendations for future research

At this point, it is important to provide suggestions concerning future research. Some of these suggestions are stemming from certain limitations of this research; other are using this research as the starting point for further investigating the investment realities in the European downstream oil sector.

The first recommendation is related to the theories that can be used for describing the characteristics of an industry similar to the downstream oil industry. As it was discussed in the limitations (paragraph [6.2](#)) of this research, integrating TCE and TCR turned out to be useful for the purpose of this thesis, but other theoretical frameworks can be tested as well. For example, the weaknesses of the TCE theory have already led to many attempts from researchers to integrate it with the resource-based view theory or with the real options theory. The potential suitability of the resource-based view theory was also revealed during the discussion in paragraph [5.4.6](#) of this report. From a purely academic perspective, it would be interesting to evaluate whether the resource-based view can fit with TCE, well-enough to depict the unique characteristics of the downstream oil industry or of other similar industries. Alternatively, it would be interesting to use the theoretical framework developed in this research as a starting point and improve it, by incorporating elements originating from other theories.

A second recommendation is to use the Q set developed in this research, update it if necessary, and conduct a similar type of Q methodology research for the same topic, by ensuring that there will be a more well-balanced sample, including more participants from the specific stakeholders' groups which are underrepresented in this research, such as from NOCs or independent refiners. Of course, managing to have a well-balanced sample with at least 20 participants, for example, would not be an easy task and it would require significant amount of time. However, given that it is feasible to have such a sample, it would be very interesting to proceed with a similar research, extract the results and compare them with the results of this research. It would then be possible to assess whether the results given in this report are significantly affected by the underrepresentation of specific viewpoints. Moreover, it would probably also be feasible to identify whether the viewpoints of participants with a similar background (e.g. all related to IOCs) are exemplified by a specific factor extracted by the software.

The last recommendation for future research would again involve conducting a Q methodology research for the same topic, but the research design would be quite different. What is proposed in this case would be to research for and create different Q sets, where each one of them would be addressed to a particular group of stakeholders. So one Q set would be administered to participants related to IOCs, a different one to participants related to independent refiners, one other to traders and so on. Such a research would definitely reveal what the different groups of stakeholders perceive as being the most or least important drivers for investments or divestments. The next step would then be to compare the results in order to demonstrate the differences in perceptions about what is driving the investments or divestments of firms involved in the business. Of course, such a research would require a very large sample, including several participants with different backgrounds, and it would be also very time consuming. However, it would be able to offer a much more detailed insight, on the exact reasons which are motivating different types of companies to behave differently with respect to investments or divestments in the European downstream oil sector. Such a research would be preferable to be conducted by at least two or three researchers, so as to be feasible to be completed in a reasonable amount of time, especially if it would be part of a Master thesis graduation project.

## 9. Bibliography

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- A. T. Kearney. (2012). *Refining 2021: Who will be in the game?* A.T. Kearney, Inc.
- Accenture. (2012). *Contemporary approaches to asset investments in the energy industry*. Accenture.
- Akerlof, G. A. (1970, August). The Market for "Lemons": Quality Uncertainty and the Market Mechanism. *The Quarterly Journal of Economics*, 84(3), 488-500.
- Al-Moneef, M. A. (1998, June). Vertical integration strategies of the national oil companies. *The Developing Economies*, XXXVI(2), 203-222.
- Al-Obaidan, A. M., & Scully, G. W. (1993). The economic efficiency of backward vertical integration in the international petroleum refining industry. *Applied Economics*, 25(12), 1529-1539.
- Al-Obaidan, A. M., & Scully, G. W. (1995). The theory and measurement of the net benefits of multinationality: the case of the international petroleum industry. *Applied Economics*, 27(2), 231-238.
- Amiel, G. (2014, February 5). *European Oil Refiners See Bleak Year*. Retrieved from The Wall Street Journal:  
<http://online.wsj.com/news/articles/SB10001424052702304680904579364140320212368>
- Anderson, E. (1985). The Salesperson as Outside Agent or Employee: A Transaction Cost Analysis. *Marketing Science*, 4(3), 234-254.
- Ascher, J., Laszlo, P., & Quiviger, G. (2012). *Commodity trading at a strategic crossroad*, McKinsey Working Papers on Risk No. 39. McKinsey & Company.
- Bakhsh, N. (2011, February 25). *Europe's Growing Diesel Deficit to Boost Storage, Woodmac Says*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2011-02-25/europe-s-growing-diesel-deficit-to-boost-storage-woodmac-says.html>
- Bakhsh, N., & Klump, E. (2010, July 22). *ConocoPhillips May Close German Refinery After Writing Off \$1.1 Billion*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2010-07-22/conocophillips-may-close-german-refinery-after-writing-off-1-1-billion.html>
- Baltic Transport Journal. (2014, March 18). *Preem to upgrade its Gothenburg refinery*. Retrieved from Baltic Transport Journal: <http://www.baltictransportjournal.com/sweden/preem-to-upgrade-its-gothenburg-refinery,1413.html>
- Barry, J., & Proops, J. (1999). Seeking sustainability discourses with Q methodology. *Ecological Economics*, 28, 337-345.
- Beddoes, C., & EUROPIA. (2010). *Perspectives for the Downstream Oil Business in Europe, Presentation at the 2nd Energy Community Forum, Belgrade, November 2010*. EUROPIA.

- Beddoes, C., & EUROPIA. (2013). *Key challenges and opportunities ahead for EU refining; Presentation at the EU Refining Forum, November 2013*. EUROPIA.
- Blas, J. (2012, February 1). *Recovering margins to boost oil refiners*. Retrieved from Financial Times: <http://www.ft.com/intl/cms/s/0/e4ce9bfa-4cb3-11e1-8741-00144feabdc0.html>
- Boncourt, M. d. (2013, March). *The European Refining Crisis: what is at stake for Europe, Les Actuelles de l'Ifri*. Paris: Ifri Centre for Energy.
- Bosoni, T., & IEA. (2013). *Recent Developments in EU Refining and in the Supply and Trade of Petroleum Products; Presentation at the EU Refining Forum, 27 November 2013*. OECD/IEA.
- Bosoni, T., & IEA. (2014). *Recent Developments in EU Refining and in the Supply and Trade of Petroleum Products; Presentation at the EU Refining Forum, 22 May 2014*. OECD/IEA.
- Bounds, A. (2011, September 15). *Foreign investment: Indian companies blaze trail across the county*. Retrieved from Financial Times: <http://www.ft.com/intl/cms/s/0/f7516d4c-d7fc-11e0-a5d9-00144feabdc0.html#axzz3ApwiY6KJ>
- Bousso, R., & Zhdannikov, D. (2013, December 20). *Europe oil refining guru back with growth plan*. Retrieved from Reuters: <http://uk.reuters.com/article/2013/12/20/uk-carlyle-europe-refining-idUKBRE9BJ0QS20131220>
- BP. (2014). *BP Statistical Review of World Energy 2014*. London: BP Statistical Review of World Energy, BP p.l.c.
- Brelsford, R., True, W., & Koottungal, L. (2013, December 2). *Western Europe leads global refining contraction*. Retrieved from Oil & Gas Journal: <http://www.ogj.com/articles/print/volume-111/issue-12/special-report-worldwide-report/western-europe-leads-global-refining-contraction.html>
- Brown, J. D. (2009). Principal components analysis and exploratory factor analysis - Definitions, differences, and choices. *Shiken: JALT Testing & Evaluation SIG Newsletter*, 13(1), 26-30.
- Brown, S. R. (1980). *Political Subjectivity: Applications of Q Methodology in Political Science*. New Haven, CT: Yale University Press.
- Business Monitor News and Views. (2013, October 9). *Mantova Conversion Highlights Ailing European Refining Sector*. Retrieved from Oil and Gas Insight : <http://www.oilandgasinsight.com/industry-news-mantova-conversion-highlights-ailing-european-refining-sector-jan-2014>
- Butler, J. D. (1953, July). The Influence of Economic Factors on the location of Oil Refineries. *The Journal of Industrial Economics*, 1(3), 187-201.
- Carlyle Group and Vito Group. (2013, December 19). *Carlyle Group and Vito Group establish midstream Varo Energy*. Retrieved from Oil & Gas Financial Journal: <http://www.ogfj.com/articles/2013/12/carlyle-group-and-vito-group-establish-midstream-varo-energy.html>

- Chazan, G. (2014, April 30). *Total profits hit by weaker refining margins and lower production*. Retrieved from Financial Times: <http://www.ft.com/intl/cms/s/0/2b981154-d06c-11e3-af2b-00144feabdc0.html>
- Chen, H., & Chen, T. J. (2003). Governance structures in strategic alliances: transaction cost versus resource-based perspective. *Journal of World Business*, 38, 1-14.
- Chevron. (2011, March 11). *Chevron to Sell Pembroke Refinery to Valero*. Retrieved from Chevron.com: [http://www.chevron.com/chevron/pressreleases/article/03112011\\_chevrontosellpembrokerefinerytovalero.news](http://www.chevron.com/chevron/pressreleases/article/03112011_chevrontosellpembrokerefinerytovalero.news)
- Coase, R. H. (1937, November). The nature of the firm. *Economica*, N.S., 4(16), 386-405.
- Cole, C. (2011, November 1). *Evolution in energy trading highlights need for improved risk management skills*. Retrieved from Oil & Gas Financial Journal: <http://www.ogfj.com/articles/2011/11/evolution-in-energy-trading-highlights-need.html>
- Cooper, S. & Wood Mackenzie. (2013). *Crude Oil in Europe: Production, Trade and Refining Outlook; Presentation at StocExpo-Antwerp, March 2013*. London: Wood Mackenzie.
- Correljé, A., & van Geuns, L. (2011). The oil industry: a dynamic patchwork of approaches. In M. Finger, & R. W. Künneke, *International Handbook of Network Industries* (pp. 197-214). Cheltenham, UK: Edward Elgar.
- Crabtree, J. (2014, June 12). *Essar to sell UK's second-biggest refinery*. Retrieved from Financial Times: <http://www.ft.com/intl/cms/s/0/f1aabbf2-f237-11e3-9015-00144feabdc0.html#axzz3ApwiY6KJ>
- Cuppen, E., Breukers, S., Hisschemöller, M., & Bergsma, E. (2010). Q methodology to select participants for a stakeholder dialogue on energy options from biomass in the Netherlands. *Ecological Economics*, 69, 579-591.
- Cuthbert, N., Leavens, J., Kennaby, D., & Birch, C. (2011). *Developments in the international downstream oil markets and their drivers: implications for the UK refining sector*. Purvin & Gertz, Inc.
- Davies, B. B., & Hodge, I. D. (2007). Exploring environmental perspectives in lowland agriculture: A Q methodology study in East Anglia, UK. *Ecological Economics*, 61, 323-333.
- Dison, J. (2011, February 1). *The future of supply trading in the oil and gas industry*. Retrieved from Oil & Gas Financial Journal: <http://www.ogfj.com/articles/print/volume-8/issue-2/features/the-future-of-supply-trading-in-the-oil.html>
- Dryzek, J. S., & Berejikian, J. (1993, March). Reconstructive Democratic Theory. *The American Political Science Review*, 87(1), 48-60.
- EC. (2011). *Energy Roadmap 2050: Impact assessment and scenarion analysis*. Brussels: European Commission.
- EC JRC-IPTS. (2014). *Intervention logic for the regulatory fitness check of the refineries sector*. Brussels: European Commission - Joint Research Centre.

- EC/DG-Energy. (2013). Summary and conclusions of the first meeting of the EU Refining Forum held on the 12th of April 2013. *Note for the file*. Brussels: European Commission, Directorate-General for Energy.
- EIA. (2014, April 22). *U.S. petroleum product exports increase in 2013*. Retrieved from US Energy Information Administration: <http://www.eia.gov/todayinenergy/detail.cfm?id=15951>
- Elliot, S. (2013, December 23). *Europe's refining moment*. Retrieved from Platts.com: [https://www.platts.com/IM.Platts.Content%5Caboutplatts%5Cmediacenter%5Cpdf%5Cinsightdec13\\_refining.pdf](https://www.platts.com/IM.Platts.Content%5Caboutplatts%5Cmediacenter%5Cpdf%5Cinsightdec13_refining.pdf)
- Ellis Jones, P. (1988). *Oil: A practical guide to the economics of world petroleum*. Cambridge: Woodhead-Faulkner Ltd.
- Ellis, G., Barry, J., & Robinson, C. (2007). Many ways to say 'no', different ways to say 'yes': Applying Q-Methodology to understand public acceptance of wind farm proposals. *Journal of Environmental Planning and Management*, 50(4), 517-551.
- Ernst & Young. (2012a). *The oil downstream: vertically challenged?* EYGM Limited.
- Ernst & Young. (2012b). *Overcoming the challenges of implementing NOC globalization ambitions*. EYGM Limited.
- Ernst & Young. (2013a). *Global oil and gas transactions review 2012*. EYGM Limited.
- Ernst & Young. (2013b). *National Oil Company Monitor Q4 2012*. EYGM Limited.
- Ernst & Young. (2014). *Global oil and gas transactions review 2013*. EYGM Limited.
- EurActiv.com, Reuters. (2014, May 23). *Russian strategy to buy up Europe's refineries exposed*. Retrieved from EurActiv.com: <http://www.euractiv.com/sections/energy/russian-strategy-buy-europes-refineries-exposed-302329>
- Fahim, M. A., Al-Sahhaf, T. A., & Elkilani, A. S. (2010). *Refinery Economics* (1st ed.). Oxford, U.K.: Elsevier.
- Fattouh, B., & Mallinson, R. (2013). *Refining Dynamics in the GCC and Implications for Trade Flows*. Oxford: The Oxford Institute for Energy Studies.
- Fielden, S. (2013, July 18). *Where the crudes have no margins – European refinery woes*. Retrieved from Oil & Gas Financial Journal: <http://www.ogfj.com/articles/2013/07/where-the-crudes-have-no-margins-european-refinery-woes.html>
- Frankel, P. H. (1969). *Essentials of Petroleum: A Key to Oil Economics* (2nd ed.). London: Frank Cass and Co. Ltd.
- Frantzi, S., Carter, N. T., & Lovett, J. C. (2009). Exploring discourses on international environmental regime effectiveness with Q methodology: A case study of the Mediterranean Action Plan. *Journal of Environmental Management*, 90, 177-186.
- Frazier, G. L., Spekman, R. E., & O'Neal, C. R. (1988, October). Just-In-Time Exchange Relationships in Industrial Markets. *Journal of Marketing*, 52(4), 52-67.

- FuelsEurope. (2013). *Annual Review 2013*. Brussels: FuelsEurope.
- FuelsEurope. (2014). *Statistical Report*. Brussels: FuelsEurope.
- Gallagher, K., & Porock, D. (2010). The use of interviews in Q methodology. *Nursing Research*, 59(4), 295-300.
- Gatignon, H., & Anderson, E. (1988). The Multinational Corporation's Degree of Control over Foreign Subsidiaries: An Empirical Test of a Transaction Cost Explanation. *Journal of Law, Economics, & Organization*, 4(2), 305-336.
- Geyskens, I., Steenkamp, J. B., & Kumar, N. (2006, June). MAKE, BUY, OR ALLY: A TRANSACTION COST THEORY META-ANALYSIS. *Academy of Management Journal*, 49(3), 519-543.
- Gismatullin, E. (2014, April 30). *Shell Writes Off \$2.3 Billion Refining Assets as Asia Adds Units*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2014-04-30/shell-writes-off-2-3-billion-refining-assets-as-asia-adds-units.html>
- Grover, V., & Malhotra, M. K. (2003). Transaction cost framework in operations and supply chain management research: theory and measurement. *Journal of Operations Management*, 21, 457-473.
- Guarerra, L. (2008). Mediterranean gasoline surplus and diesel shortage: the impending conversion bottleneck. *OPEC Energy Review March 2008*, 88-104.
- Guttman, L. (1954). Some necessary conditions for common factor analysis. *Psychometrika*, 19(2), 149-161.
- Harman, H. H. (1976). *Modern Factor Analysis* (3rd ed.). Chicago: University of Chicago Press.
- Henisz, W. J. (2000). The Institutional Environment for Multinational Investment. *Journal of Law, Economics, and Organization*, 16(2), 334-364.
- Hobbs, J. E. (1996). A transaction cost approach to supply chain management. *Supply Chain Management*, 1(2), 15-27.
- Holter, M. (2014, January 13). *Shell to Sell Norwegian Downstream Assets to Meet Spending Goal*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2014-01-13/shell-to-sell-norwegian-downstream-assets-to-meet-spending-goal.html>
- Hureau, G., Serbutoviez, S., Silva, C., & Maisonnier, G. (2013). *Investment in exploration-production and refining 2013*. IFP Énergies nouvelles.
- IEA. (2008). *Medium-Term Oil Market Report*. Paris: OECD/IEA.
- IEA. (2009). *Medium-Term Oil Market Report*. Paris: OECD/IEA.
- IEA. (2011). *Medium-Term Oil & Gas Markets 2011*. Paris: OECD/IEA.
- IEA. (2012). *Oil: Medium-Term Market Report 2012*. Paris: OECD/IEA.
- IEA. (2013a). *Recent Developments in EU Refining and Product Supply; Presentation at the EU Refining Forum, 12 April 2013*. OECD/IEA.

- IEA. (2013b). *Oil: Medium-Term Market Report 2013*. Paris: OECD/IEA.
- Joskow, P. L. (1985). Vertical Integration and Long-Term Contracts: The Case of Coal-Burning Electric Generating Plants. *Journal of Law, Economics, & Organization*, 1(1), 33-80.
- Kaiser, H. F. (1960). The application of electronic computers to factor analysis. *Educational and Psychological Measurement*, 20(1), 141-151.
- Kemp, J. (2013, November 20). *COLUMN-EU must enforce restructuring of refining sector: Kemp*. Retrieved from Reuters: <http://www.reuters.com/article/2013/11/20/eu-refining-idUSL5N0J53JJ20131120>
- Kemp, J. (2013, November 29). *COLUMN-Facing a Kodak moment, EU oil refiners must invest or die*. Retrieved from Reuters: <http://uk.reuters.com/article/2013/11/29/eu-refining-idUKL5N0JE1W620131129>
- Kesicki, F. (2010). The third oil price surge - What's different this time? *Energy Policy*, 38, 1596-1606.
- Kirchfeld, A., Comfort, N., & Campbell, M. (2012, July 5). *Exxon Mobil Said to Explore Sale of German Gas Stations*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2012-07-04/exxon-mobil-said-to-explore-sale-of-german-esso-gas-stations.html>
- Klein, B. (1980, May). Transaction Cost Determinants of "Unfair" Contractual Arrangements. *The American Economic Review*, 70(2), 356-362.
- KPMG. (2012). *The Future of the European Refining Industry*. KPMG LLP.
- Lal, N. (2014, January 10). *Will Europe's petrochemical industry follow the fate of oil refining?* Retrieved from Platts.com: <http://www.platts.com/news-feature/2014/petrochemicals/europe-2014-outlook/index>
- Leiblein, M. J. (2003). The Choice of Organizational Governance Form and Performance: Predictions from Transaction Cost, Resource-based, and Real Options Theory. *Journal of Management*, 29(6), 937-961.
- Levin, R. C. (1981). Vertical Integration and Profitability in the Oil Industry. *Journal of Economic Behavior and Organization*, 2(3), 215-235.
- Loder, A. (2014, January 8). *Unforeseen U.S. Oil Boom Upends Markets as Drilling*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2014-01-08/unforeseen-u-s-oil-boom-upends-world-markets-as-drilling-spreads.html>
- Lyons, B. R. (1995). Specific investment, economies of scale, and the make-or-buy decision: A test of transaction cost theory. *Journal of Economic Behavior and Organization*, 26, 431-443.
- Mariti, P., & Smiley, R. H. (1983, June). Co-Operative Agreements and the Organization of Industry. *The Journal of Industrial Economics*, 31(4), 437-451.
- Masten, S. E., Meehan, J. W., & Snyder, E. A. (1991). The costs of organization. *Journal of Law, Economics, & Organization*, 7(1), 1-25.

- Mayer, K. J., & Salomon, R. M. (2006, October). Capabilities, Contractual Hazards, and Governance: Integrating Resource-Based and Transaction Cost Perspectives. *The Academy of Management Journal*, 49(5), 942-959.
- Meijknecht, J., Correljé, A., & van Holk, B. (2012). *A Cinderella Story: Restructuring of the European Refining Sector*. Clingendael International Energy Programme. The Hague: Clingendael International Energy Programme.
- Migliaccio, A. (2014, April 29). *Eni Profit Falls on Weak Demand and Declining Refining Margins*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2014-04-29/eni-profit-falls-on-weak-demand-and-declining-refining-margins.html>
- Monteverde, K. (1995, October). Technical Dialog As an Incentive for Vertical Integration in the Semiconductor Industry. *Management Science*, 41(10), 1624-1638.
- Nelson, R., & CONCAWE. (2013). *EU Refining Competitiveness and impact of planned legislation; Presentation at the EU Refining Forum, 27 November 2013*. CONCAWE.
- Nguyen, L., & Voss, S. (2012, March 28). *Vitol CEO Says Atlantic Refinery Closings Spur Long-*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2012-03-28/vitol-ceo-says-atlantic-refinery-closings-spur-long-distance-oil.html>
- Oil & Gas Financial Journal. (2009, November 10). *Multinationals on the move - refineries on the up in Asia Pacific*. Retrieved from Oil & Gas Financial Journal: <http://www.ogfj.com/articles/2009/11/multinationals-on.html>
- Oil & Gas Financial Journal. (2010, November 29). *Purvin & Gertz Launches Global Crude Oil Market Outlook*. Retrieved from Oil & Gas Financial Journal: [http://www.ogfj.com/articles/2010/11/purvin-\\_\\_gertz\\_launches.html](http://www.ogfj.com/articles/2010/11/purvin-__gertz_launches.html)
- Oil & Gas Financial Journal. (2012, March 21). *Oil companies exiting refining business*. Retrieved from Oil & Gas Financial Journal: <http://www.ogfj.com/articles/2012/03/oil-companies-exiting-refining-business.html>
- Oil & Gas Journal. (2011, March 11). *Valero to buy Chevron's Pembroke refinery*. Retrieved from Oil & Gas Journal: <http://www.ogj.com/articles/2011/03/valero-to-buy-chevron.html>
- Oil & Gas Journal. (2014, July 24). *Romanian refinery wraps modernization project*. Retrieved from Oil & Gas Journal: <http://www.ogj.com/articles/2014/07/romanian-refinery-wraps-modernization-project.html?sponsored=topic4&cmpid=EnlRefiningAugust182014>
- Oil & Gas Journal Editors. (2014, April 7). *Moody's: Global refining, marketing industry to see earnings rise this year*. Retrieved from Oil & Gas Journal: <http://www.ogj.com/articles/2014/04/moody-s-global-refining-marketing-industry-to-see-earnings-rise-this-year.html>
- Oil and Energy Trends. (2010, August). OECD's refiners face future of refinery cuts. *Oil and Energy Trends*, 35(8), 3-6.
- Oil and Energy Trends. (2011a, June). Europe's refiners face bleak future. *Oil and Energy Trends*, 36(6), 13-14.

- Oil and Energy Trends. (2011b, November). Refinery shake-out looms in Atlantic Basin. *Oil and Energy Trends*, 36(11), 3-6.
- Oil and Energy Trends. (2012a, July). Europe struggles to balance refinery slate. *Oil and Energy Trends*, 37(7), 3-6.
- Oil and Energy Trends. (2012b, October). Signs of US refining revival as Europe remains in doldrums. *Oil and Energy Trends*, 37(10), 13-14.
- Oil and Energy Trends. (2012c, February). World refining: Western decline vs. Eastern growth. *Oil and Energy Trends*, 37(2), 10-17.
- Oil and Energy Trends. (2013, August). Europe's refiners face further closures as demand falls and competition grows. *Oil and Energy Trends*, 38(8), 10-18.
- Oil and Energy Trends. (2013b, June). Unions protest as another French refinery closes. *Oil and Energy Trends*, 38(6), 10.
- Oil and Energy Trends. (2014, March). European refinery closures continue as foreign competition increases. *Oil and Energy Trends*, 39(3), 3-6.
- Patel, T. (2010, October 29). *Total Profit Climbs 32% as Fields Come On Stream, Price of Oil Increases*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2010-10-29/total-profit-climbs-32-as-fields-come-on-stream-price-of-oil-increases.html>
- Patel, T. (2013, April 16). *France's Petit-Couronne Refinery to Shut After Bids Rejected*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2013-04-16/french-court-rejects-all-offers-for-petit-couronne-refinery.html>
- Patel, T. (2013, September 4). *Total to Shut French Steam Cracker in Switch to Resins*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2013-09-04/total-to-shut-french-steam-cracker-at-carling-in-switch-to-resin.html>
- Patel, T., & Gismatullin, E. (2013, September 23). *Total Sees Output Increase Through 2017 as Spending Peaks*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2013-09-23/total-sees-production-increase-through-2017-as-spending-peaks.html>
- Patel, T., & Swint, B. (2012, September 25). *Total May Look to North Sea, Africa for \$20 Billion in*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2012-09-25/total-may-look-to-north-sea-africa-for-20-billion-in-sales-2-.html>
- Penrose, E. T. (1968). *The Large International Firm in Developing Countries: The International Petroleum Industry* (1st ed.). London, U.K.: George Allen and Unwin Ltd.
- Pfeifer, S., & Blitz, J. (2011, January 10). *PetroChina takes stake in UK refinery*. Retrieved from Financial Times: <http://www.ft.com/intl/cms/s/0/72b5e6e8-1cd2-11e0-a106-00144feab49a.html#axzz3ApwiY6KJ>
- Pirrong, G. (2014). *The Economics of Commodity Trading Firms*. Craig Pirrong & Trafigura.
- Porter, M. E. (1979, March-April). How competitive forces shape strategy. *Harvard Business Review*, 137-145.

- Prequin. (2013, December 19). *Carlyle Announces Second Energy Deal in a Week*. Retrieved from Prequin: <https://www.prequin.com/item/carlyle-announces-second-energy-deal-in-a-week/102/8062>
- ResearchViews. (2013, January 29). *Rubis Terminal Completes Acquisition Of Storage And Distribution Business Of Reichstett Refinery From Petroplus*. Retrieved from ResearchViews.com: <http://www.researchviews.com/energy/oil-gas/oil-gas-storage/DealReport.aspx?sector=Oil%20and%20Gas%20Storage&DealID=215503>
- Resnick-Ault, J., & McCracken, J. (2011, March 10). *Valero Said to Buy Chevron's U.K. Refinery for \$2*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2011-03-10/valero-said-to-buy-chevron-u-k-refinery-for-about-2-billion.html>
- Rindfleisch, A., & Heide, J. B. (1997). Transaction cost analysis: past, present and future applications. *Journal of Marketing*, 61(4), 30-54.
- Rozhnov, K. (2013, April 5). *Europe to Shut 10 Refineries as Profits Tumble*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2013-04-04/europe-to-shut-10-refineries-as-profits-tumble.html>
- Rozhnov, K., & Gross, J. (2012, June 7). *Investment in West's Refineries Isn't All Good News*. Retrieved from The Wall Street Journal: <http://online.wsj.com/news/articles/SB10001424052702303665904577452162526770508>
- Rudnitsky, J. (2012, September 20). *Gunvor Is 'Major Force' in Russia After Rosneft Tender Loss*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2012-09-20/gunvor-to-stay-major-force-in-russia-after-rosneft-tender-loss.html>
- Rudnitsky, J., & Shiryayevskaya, A. (2012, October 31). *Gunvor Wins Rosneft One-Year Oil Contract; More May Follow*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2012-10-31/gunvor-wins-rosneft-s-one-year-tender-to-export-oil-products-1-.html>
- Schmolck, P. (2014, June 27). *PQMethod (version 2.35)*. Retrieved July 24, 2014, from <http://schmolck.userweb.mwn.de/qmethod/downpqwin.htm>
- Shelanski, H. A., & Klein, G. P. (1995, October). Empirical Research in Transaction Cost Economics: A Review and Assessment. *Journal of Law, Economics, & Organization*, 11(2), 335-361.
- Simon, H. A. (1957). *Models of Man: Social and Rational*. New York: Wiley.
- Smith, G. (2013, February 28). *Vitol's Energy Trading Revenue Rose 2% to \$303*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2013-02-28/vitol-s-energy-trading-revenue-rose-2-to-303-billion-in-2012.html>
- Spiller, P. T. (2011, July). Transaction Cost Regulation. *National Bureau of Economic Research working paper No. 16735*.
- Stephenson, W. (1953). *The Study of Behavior: Q Technique and its Methodology*. Chicago: University of Chicago Press.
- Stevens, P. (2009). *Transit Troubles: Pipelines as a Source of Conflict*. London: The Royal Institute of International Affairs, Chatham House.

- Suhr, D. D. (2005, April 10-13). Principal Component Analysis vs. Exploratory Factor Analysis. *SUGI 30 Proceedings*, 203-30.
- Sykes, L. (2013, October 22). *The new global refining centres*. Retrieved from Arabian Oil and Gas.com: <http://www.arabianoilandgas.com/article-11498-the-new-global-refining-centres/>
- Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Upper Saddle River, NJ: Pearson Allyn & Bacon.
- Tirone, J. (2013, December 19). *Carlyle-Vitol Venture to Buy Bayernoil Refinery Stake*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2013-12-19/carlyle-vitol-venture-to-buy-bayernoil-refinery-stake.html>
- Tirone, J., & Bergman, J. (2013, August 19). *OMV Pays Record \$2.65 Billion for Statoil North Sea Oil, Gas*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2013-08-19/omv-pays-record-2-65-billion-to-statoil-for-north-sea-oil-gas.html>
- Vernon, R. (1971). *Sovereignty at Bay: The Multinational Spread of US Enterprises*. New York: Basic Books.
- Walker, G., & Poppo, L. (1991, March). Profit Centers, Single-Source Suppliers, and Transaction Costs. *Administrative Science Quarterly*, 36(1), 66-87.
- Walker, G., & Weber, D. (1984, September). A Transaction Cost Approach to Make-or-Buy Decisions. *Administrative Science Quarterly*, 29(3), 373-391.
- Watts, S., & Stenner, P. (2012). *Doing Q Methodological Research*. London: SAGE Publications Ltd.
- Werber, C. (2013, September 19). *European Refining Is Urged to Shrink Further*. Retrieved from The Wall Street Journal: <http://online.wsj.com/news/articles/SB10001424127887323808204579084860226698406>
- Williams, S., & Stiff, P. (2014, July 2). *Exxon Mobil to Plow \$1 Billion Into Belgian Refinery*. Retrieved from The Wall Street Journal: <http://online.wsj.com/articles/exxon-mobil-to-plow-1-billion-into-belgian-refinery-1404286424>
- Williamson, O. E. (1971, May). The Vertical Integration of Production: Market Failure Considerations. *The American Economic Review*, 61(2), 112-123.
- Williamson, O. E. (1973, May). Markets and Hierarchies: Some Elementary Considerations. *The American Economic Review*, 63(2), 316-325.
- Williamson, O. E. (1975). *Markets and Hierarchies: Analysis and Antitrust Implications*. New York: The Free Press.
- Williamson, O. E. (1983, September). Credible Commitments: Using Hostages to Support Exchange. *The American Economic Review*, 73(4), 519-540.
- Williamson, O. E. (1985). *The Economic Institutions of Capitalism: Firms, Markets, Relational Contracting*. New York: Free Press.
- Williamson, O. E. (1996). *The mechanisms of governance*. New York: Oxford University Press.

- Williamson, O. E. (2005). Transaction Cost Economics. In C. Ménard, & M. M. Shirley, *Handbook of New Institutional Economics* (pp. 41-65). Dordrecht: Springer.
- Williamson, O. E. (2008, April). OUTSOURCING: TRANSACTION COST ECONOMICS AND SUPPLY CHAIN MANAGEMENT. *Journal of Supply Chain Management*, 44(2).
- Young, M., & Mumby, H. (2013, August 7). *Big oil struggles in Q2 2013*. Retrieved from Oil & Gas Financial Journal: <http://www.ogfj.com/articles/2013/08/big-oil-struggles-in-q2-2013.html>

## Appendix A: Dynamics and developments in the European downstream oil sector

This Appendix elaborates on the current dynamics in the European downstream oil sector and the challenges with which firms and policy makers are confronted with. The main trends influencing the sector are identified and this analysis reveals in a crude manner, some of the major drivers for both investment and divestment decisions by specific firms involved in the European downstream oil business.

### Falling demand for oil products in Europe

The first major trend has to do with the falling demand for oil products in the European market. Indeed, since 2008 (with the outbreak of the financial crisis) has been noticed a decrease in the overall demand for refined products in the European Union (EU) and for the period 2008-2013 this overall demand decline was about 13%. Nevertheless, the demand has not been decreased for all oil products by the same rate, as for example gasoline demand declined by 20% for this five-year period, whereas the demand for middle distillates, gasoil and diesel declined by only 7% (FuelsEurope, 2014). These trends are illustrated in the following figure.

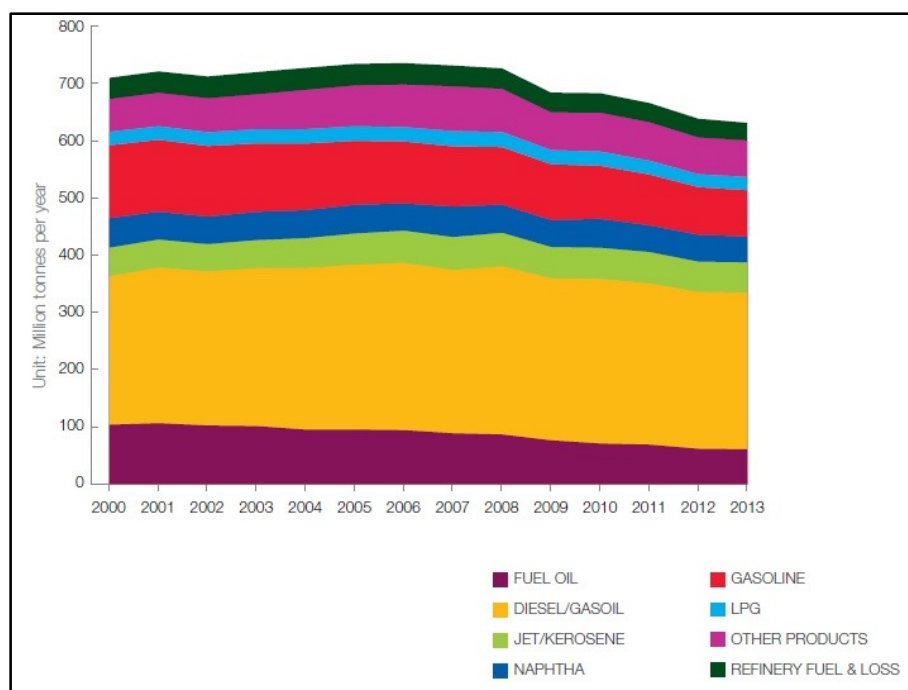


**Figure 1: Demand history of oil products in the EU (FuelsEurope, 2014); (Based on data from Wood Mackenzie).**

It is obvious from the figure that demand for middle distillates in the European market is still significantly higher than demand for all other oil products, partly explaining the lower demand declining

rate for diesel and gasoil. The BP Statistical Review of World Energy 2014 (2014) informs that the total consumption of oil products in Europe reached a total of 14,086 kb/d in 2013, where middle distillates constituted a 52.8% (or 7,439 kb/d) of the total consumption, light distillates constituted a 20.9% (or 2,941 kb/d), fuel oil constituted a 6.8% (or 957 kb/d) and other products (refinery gas, LPG, solvents, petroleum coke, lubricants, bitumen, wax, other refined products and refinery fuel and loss) constituted the remaining 19.5% (or 2,749 kb/d). It is interesting however to notice that although the overall refined products consumption in 2013 declined by 0.8% compared to 2012, along with the consumption of light distillates and fuel oil which also dropped by 2.0% and 9.7% respectively during the same period, the situation is changing when it comes to middle distillates and the other refined products. The reason is that demand for these oil products increased by 0.3% and 0.8% respectively for the period 2012-2013, thus highlighting contrasting patterns for middle distillates and other refined products consumption, compared to overall oil products demand. The specificities of oil product demand patterns in Europe, will be presented in the following paragraph, as in this section the focus is more on the general demand level for oil products in Europe.

Obviously, the 20% decrease in the demand for gasoline in the EU hit the European refining sector hard and put serious pressure on refiners. This development, combined with several other dynamics, forced many European refineries to exit the business or even to file for bankruptcy (characteristic example Petroplus). Apart from the reduced economic activity in many European countries, many other factors are to blame for this general fall in demand, such as the more efficient use of oil products or the substitution effects by, for example, bio-fuels (FuelsEurope, 2013). The higher efficiency of new diesel and gasoline car engines, has significantly contributed to this downward trend of oil products demand (Cuthbert, Leavens, Kennaby, & Birch, Developments in the international downstream oil markets and their drivers: implications for the UK refining sector, 2011), as well as the increasing use of electricity in the transport sector due to the environmental legislation of EC. All factors are important but the effect on oil products demand due to substitution by alternative fuels will draw some more attention in one of the following sections of this Appendix.

More importantly, the future oil products demand outlook does not allow for optimism for the European refining sector. According to the International Energy Agency (2013b), Europe is facing a situation where demand will keep declining for both oil products and crude oil, however this decline will be faster for the latter than for the former, leading to an increased dependency on imports of oil products.

### **European oil products demand and Europe-World trade patterns**

As discussed in the previous paragraph, there are differences in the demand patterns for oil products in Europe. The most significant trends which can be identified, is the low demand for gasoline and the increased demand for diesel and other middle distillates. A major factor which has led to this increased demand for diesel is actually the tax incentives provided in many EU member states, supporting the use of diesel instead of gasoline as a road fuel. Characteristic examples of European countries with significant imbalances in the use of diesel and gasoline as a road fuel are France and Spain. The diesel-use favorable tax regimes have led to a demand five and four times higher than for gasoline in France and Spain respectively (FuelsEurope, 2014).

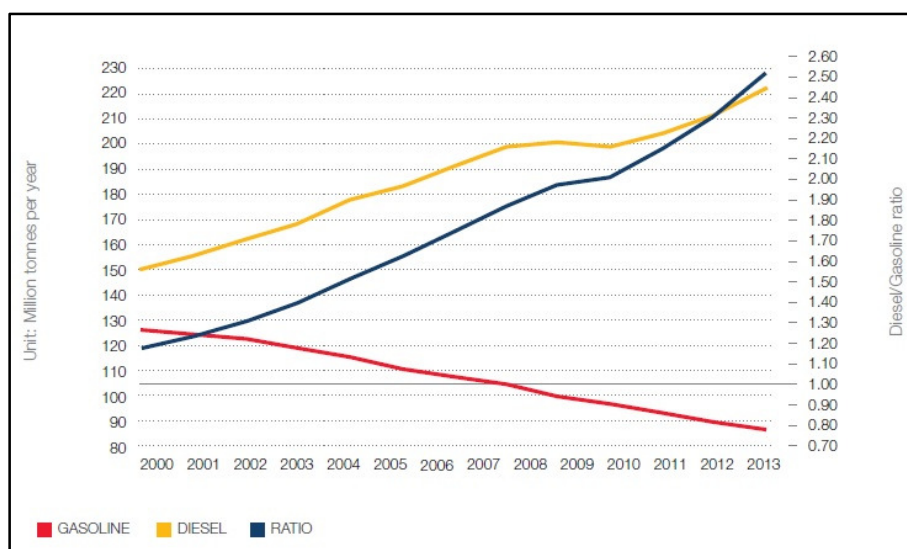


**Figure 2: Road fuel demand in the EU in 2013 (FuelsEurope, 2014); (Based on data from Wood Mackenzie).**

As it is illustrated in the previous figures, the dieselization trend of the European car fleet had a significant impact on the road fuel demand structure leading to the current situation, where demand for diesel is actually increasing contrary to declining demand for gasoline (FuelsEurope, 2014).

Nevertheless, the car fleet dieselization trend in Europe and the fact that the European market demands significantly more diesel and less gasoline in general, would not necessarily pose a problem for the refining sector. The reality though is that many refineries in Europe are configured to produce mainly gasoline and not middle distillates (Meijknecht, Correljé, & van Holk, 2012); (KPMG, 2012), so they are by definition under pressure insofar the market asks for more of the latter product.

The demand for gasoline has persistently remained lower than its supply during the previous years, creating a serious gasoline surplus in the Europe which could only be exported to other markets.

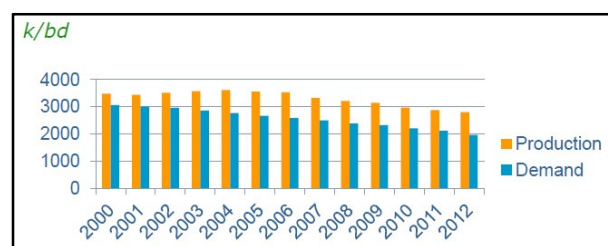


**Figure 3: Gasoline production and demand in Europe (IEA, 2013a).**

The situation was exacerbated from the fact that, changing the configuration of a refinery to produce more middle distillates is a costly and lengthy procedure, which makes upgrading investments in hydrocracking or other units a tough decision. A cheaper short-term solution for a refiner is to increase the crude oil throughput in order to produce larger quantities of middle distillates, which however results in production of more gasoline and other fuels as by-products (IEA, 2013a).

Therefore, the combination of increased demand for diesel and other middle distillates, along with the increased production of gasoline by many European refineries, has led to a situation where there is middle distillates (especially diesel and kerosene) deficit and gasoline surplus in the European market. Hence, this imbalance in the supply and demand patterns in Europe, has led to trade imbalances as well,

with increasing exports of gasoline and imports of middle distillates during the recent years, as it is illustrated from the net trade flows for refined products in the EU. So, for example, the net gasoline exports reached 46,322 ktonnes in 2012, while diesel/gasoil and jet fuel net imports reached 14,344 ktonnes and 14,042 ktonnes respectively (FuelsEurope, 2014). Specifically for jet fuel, the need for imports can be attributed to the increased demand due to the rapid growth in aviation (especially after 1990), which outstripped regional supply (Cuthbert, Leavens, Kennaby, & Birch, Developments in the international downstream oil markets and their drivers: implications for the UK refining sector, 2011).

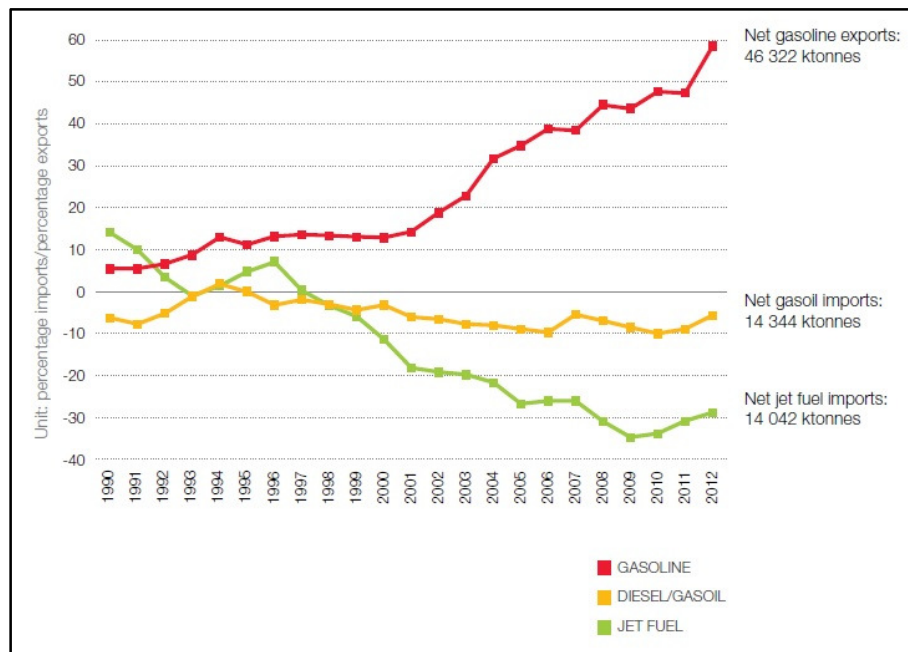


**Figure 4: Net trade flows for refined products (FuelsEurope, 2014); (Based on data from Eurostat).**

The vast majority of middle distillates reaching the European market are exported from refineries in Russia, in the US, and in Asia and the Middle East (IEA, 2013b); (Meijknecht, Correljé, & van Holk, 2012); (KPMG, 2012). It is worth mentioning that for the year 2012, diesel/gasoil import flows to the EU originated mainly from Russia (11,9 million tonnes) and from North America (10,5 million tonnes), the former accounting for 44% of total imports and the latter for 39% respectively. Concerning jet fuel imports for the same year, a stunning 69% originated from refineries in Middle East (FuelsEurope, 2014).

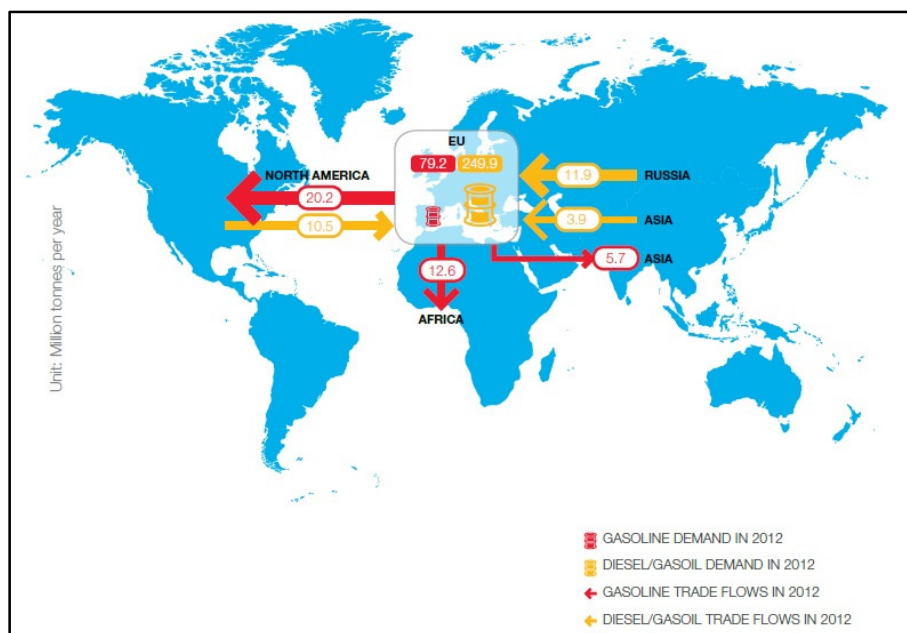


Figure 5: Major gasoline and diesel trade flows to and from the EU in 2012 (FuelsEurope, 2014); (Based on data from Eurostat).

On the other hand, the surplus of gasoline in Europe can only be exported to other regional markets, and traditionally, the main destination has been the US market and to a lesser extent the African market (KPMG, 2012); (FuelsEurope, 2014). As it can be seen in the following figure, US market has been the main export market for EU gasoline surplus, for the period 2000-2008.

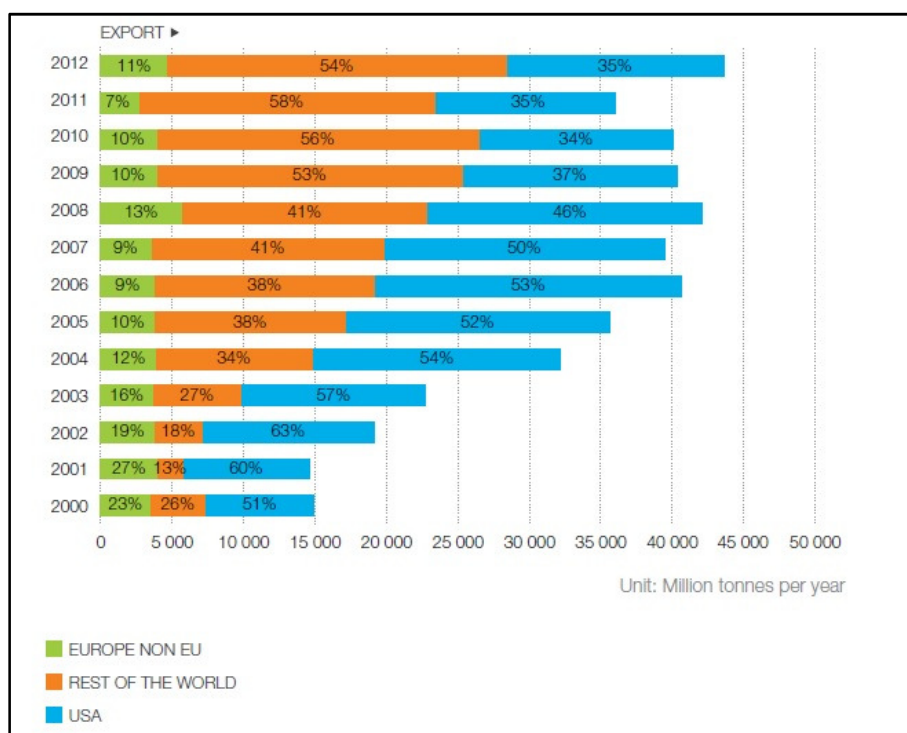


Figure 6: EU gasoline trading balance (FuelsEurope, 2014); (Based on data from Eurostat).

However, during the years which followed 2008, there was a rapid decrease of the US share of exported gasoline from the EU, which dropped from 46% to 35%. This can be attributed to several reasons. First, the US domestic demand for gasoline also decreased during the recent years and especially since 2006 (KPMG, 2012), as a result of increasing volumes US produced bio-fuels (primarily ethanol) blended into gasoline, of increasing fuel efficiency of car engines, of increasing adoption of diesel-motor vehicles, and last but not least, of the continued upgrading of US refineries with catalytic crackers enabling them to produce more gasoline (Meijknecht, Correljé, & van Holk, 2012). A second reason is that the new heavy crude production from Canadian oil sands and the shale oil and gas revolution, led to cheaper feedstocks and energy costs for US refiners. This in turn increased their cost-competitiveness and gave them the ability to supply their domestic market with more gasoline at lower prices, thus undermining EU gasoline exports. Furthermore, US refiners could now compete with their European counterparts not only in the US market, but also in other export markets for gasoline around the globe (IEA, 2013b); (FuelsEurope, 2014).

To conclude about the oil products demand patterns and trade flows in Europe, it seems unlikely that the current situation will change dramatically in the near future. Europe will keep being dependent on middle distillate imports from other regions (Cuthbert, Leavens, Kennaby, & Birch, Developments in the international downstream oil markets and their drivers: implications for the UK refining sector, 2011); (Meijknecht, Correljé, & van Holk, 2012), while at the same time the potential gasoline export markets will keep becoming more tight, forcing European refiners to switch focus from the US to other regions. A forecast made in 2012 for the European oil product imbalances is illustrated in the following figure.

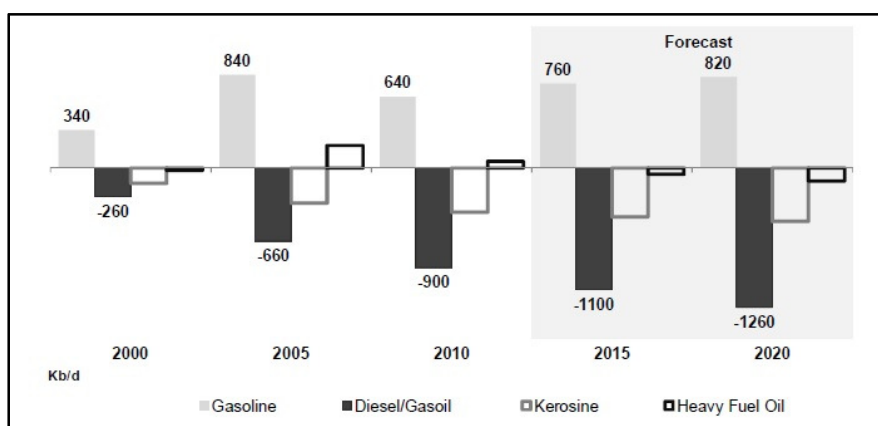


**Figure 7: European oil product imbalance (Meijknecht, Correljé, & van Holk, 2012); (Based on data from Clingendael International Energy Program/CIEP, IEA, Wood Mackenzie, Purvin & Gurtz).**

Next to this, the European refining sector will keep facing a fierce competition from refiners in Russia, US, Middle East and to a lesser extent Asia (mainly China and India), not only in terms of supplying the European domestic market with middle distillates, but also for exporting its gasoline surplus to regions outside of Europe. The characteristics of this competition are the next topic of discussion.

## Existing and emerging competition

The previous section introduced the kind of competition that European refiners face from their counterparts in other regions of the world. In this section the characteristics of this competition will be

analyzed. The European refining sector is facing threats stemming mainly from the US, Russia, Middle East and to a lesser extent from some Asian countries such as India and China. The focus will be first on competition from the other side of the Atlantic.

### The revival of the US refining sector

It was already mentioned that the US refining sector has started benefiting the recent years from the new production of heavy crude from Canadian oil sand and from the shale oil and gas revolution. These developments have enabled US (East Coast) refineries to access cheap domestic tight oil feedstocks and to lower their energy operating costs from cheap shale gas (EC/DG-Energy, 2013); (Fattouh & Mallinson, 2013). Moreover, as de Boncourt (2013, p. 2) puts it “a virtuous cycle is being set up (in the US) because of the shale gas boom, the proximity of production with refineries decreasing the cost of transport, the high quality of feedstocks coming from shale oil improving the refinery yield”, which has led to the revival of the US refining sector. It is worth mentioning that whereas in Europe, the energy costs represent more than 60% of refining costs, this percentage has been reduced to approximately 20% in the US (IEA, 2013a). These developments have not only offered the opportunity to US refiners to supply their domestic gasoline market with products at lower prices, than the ones offered by European refiners, but it has enabled them to compete in other regional gasoline markets, such as Latin America and Africa (Oil and Energy Trends, 2013). Hence, the European refining sector is experiencing a loss of market share not only in the US, but also in alternative global markets. A good example is the gasoline market of West Africa. Although this market was traditionally dominated by European refiners, the recent years have seen increasing volumes of US gasoline penetrating this market. Thus, while in 2008 there were almost no gasoline exports from the US to West Africa, in 2014 US refiners reached to supply approximately one fifth of the total 300.000 b/d gasoline demand of this market (Oil and Energy Trends, 2014).

Nevertheless, the competition is not only restrained in the gasoline markets. As it was highlighted, US refining sector has the second largest share of middle distillate exports in the European market. The increased diesel and gasoil production of US refineries can also be attributed to the sector renaissance due to the new shale technologies and their rapid adoption in North America. As a matter of fact, US diesel exports have rapidly increased over the last four years and a vast amount of these exports have been channeled to Europe (Fattouh & Mallinson, 2013). According to the US Energy Information Administration (2014), average exports of distillate fuels exceeded 1.1 million b/d in 2013, from which an average of 400,000 b/d reached Europe, a number increased by 50,000 b/d since 2012.

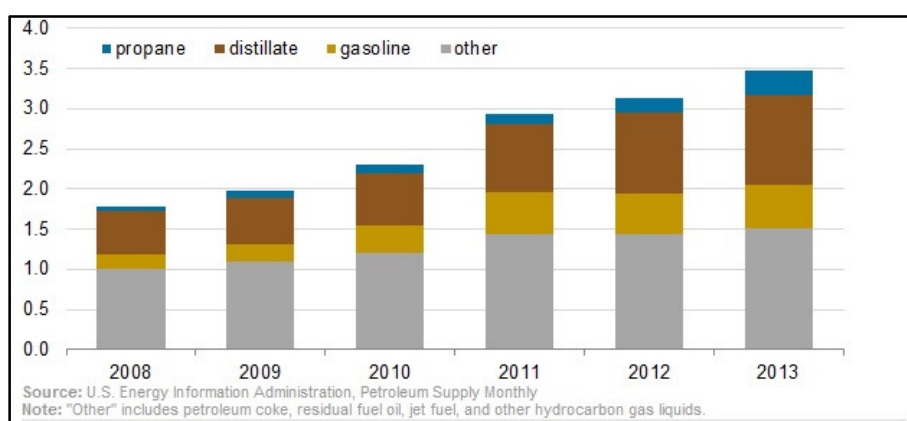


Figure 8: Average annual petroleum product exports (million b/d) (EIA, 2014).

To conclude, the European refining sector is facing serious competition from the US in two different fields: firstly in Europe in the race to supply the region with middle distillates, and secondly in the US, Africa and Latin America, in the race to export gasoline to those markets. This form of competition is most likely to continue under the current conditions both in Europe and the US.

### **The Russian refining sector modernization**

The second important form of competition comes from the Russian refining sector. The fact that Russian refiners are a major exporter of middle distillates and heavy fuel oil into the European market can be largely attributed to the Russian oil export tax regime, as the tax on refined products exports was lower than the one on crude oil exports (Cuthbert, Leavens, Kennaby, & Birch, *Developments in the international downstream oil markets and their drivers: implications for the UK refining sector*, 2011). This exports subsidization created great incentives to refine crude in Russia and export the oil products in other markets, such as Europe, and these exports have grown substantially between 2003 and 2010. Moreover, the low taxes on exports of heavy fuel oil motivated Russian refiners to maximize fuel oil production and increasing their exports. The oversupply of fuel oil in Europe has caused its price to drop, which in turn led to sustained negative margins for simple European refineries-producers of significant amounts of fuel oil. The result has been that many of these refineries were forced to either idle or close. The effects due the increased middle distillates exports were not the same as for the fuel oil, because demand for diesel and other middle distillates has been constantly increasing in the European market and the Russian exports were not sufficient enough to meet it (Cuthbert, Leavens, Kennaby, & Birch, *Developments in the international downstream oil markets and their drivers: implications for the UK refining sector*, 2011).

The tax regime indeed stimulated exports of middle distillates and heavy fuel, but at the same time there was a lack of incentives to undertake any costly investments in cracking or other upgrading units. In this way, even non-complex refineries were able to keep operating by exporting fuel oil and other middle distillates and maximizing their profits without the need to invest in their modernization. Nevertheless, the lack of investments in cracking and other units, made the Russian refining sector incapable to produce more gasoline and light distillates. This posed a serious problem during the previous years, because domestic demand in Russia was mainly concerned with gasoline which the local refineries were incapable of producing and supplying (Oil and Energy Trends, 2014); (Cuthbert, Leavens, Kennaby, & Birch, *Developments in the international downstream oil markets and their drivers: implications for the UK refining sector*, 2011). The Russian tax regime worked therefore as a barrier for investments in general, which resulted in a refining sector with plants of low complexity and desulphurization capacity. This in turn introduced a second problem for Russian refiners, namely the inability to produce diesel meeting the tight European specifications for sulphur content. This situation deteriorated especially after 2008 and the 50% reduction of sulphur content in European diesel, from 0.2% to 0.1%, which resulted in a declining quantities of imported diesel and gasoil from Russia (Meijknecht, Correljé, & van Holk, 2012).

All the previous developments forced the Russian government to take actions in order to stimulate the modernization and restructuring of the domestic refining industry. The decision was made to change the taxation regime, by increasing taxes for export of fuel oil from 66% of crude oil to 75% in 2014 and 100% in 2015. At the same time, the duties on “clean” products (such as diesel, jet fuel with the

exception of gasoline), will be reduced from 66% of crude oil to 65%, 63% and 61% in 2014, 2015 and 2016 respectively (Bosoni & IEA, 2013). These changes, which became effective from 1st of January 2014, are part of the famous “60:66” tax framework which intends to promote the production of white fuels including diesel and also promote improvements in the quality of gasoline. It is also expected that the increased diesel production will be accompanied by a decline of fuel oil exports (Oil and Energy Trends, 2014); (Fattouh & Mallinson, 2013). The idea is that these changes will “force” Russian refiners to proceed to investments in upgrading units and hydrodesulphurization capacity, which will enable them to increase the complexity of their plants and become able to produce high quality fuels. This in turn will enable them to compete with complex refineries from other regions both in markets across the EU, and in those outside Europe that are normally supplied by refineries in the EU. Russian refineries are already under this major modernization phase and when the restructuring process will have been completed, they will become capable to export more ultra-low sulphur diesel of the latest EU specifications both in the European and in other regional markets (Oil and Energy Trends, 2014); (Oil and Energy Trends, 2013); (Fattouh & Mallinson, 2013); (Cuthbert, Leavens, Kennaby, & Birch, Developments in the international downstream oil markets and their drivers: implications for the UK refining sector, 2011).

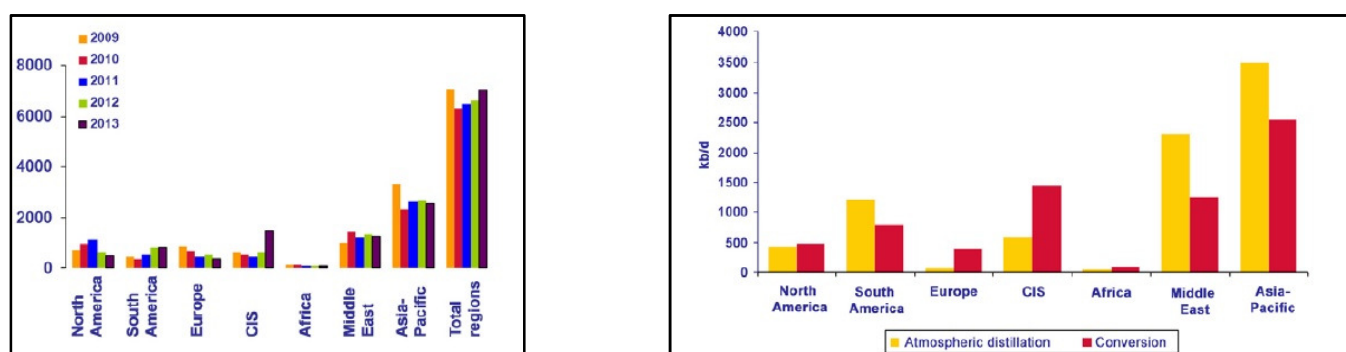


**Figure 9: Conversion capacity investments by geographical region (kb/d) and distribution of new capacity (in 2013) by project type: distillation/conversion (Hureau, Serbutoviez, Silva, & Maisonnier, 2013); (Based on data from KBC).**

As it can be noticed in the previous figures, the number of investments in conversion capacity in the CIS countries (including Russia) skyrocketed in 2013, compared to the previous years from 2009 to 2012. Moreover, it is noteworthy that in 2013 more than 70% of the total number of the current refining projects in Russia accounts for conversion projects (Hureau, Serbutoviez, Silva, & Maisonnier, 2013).

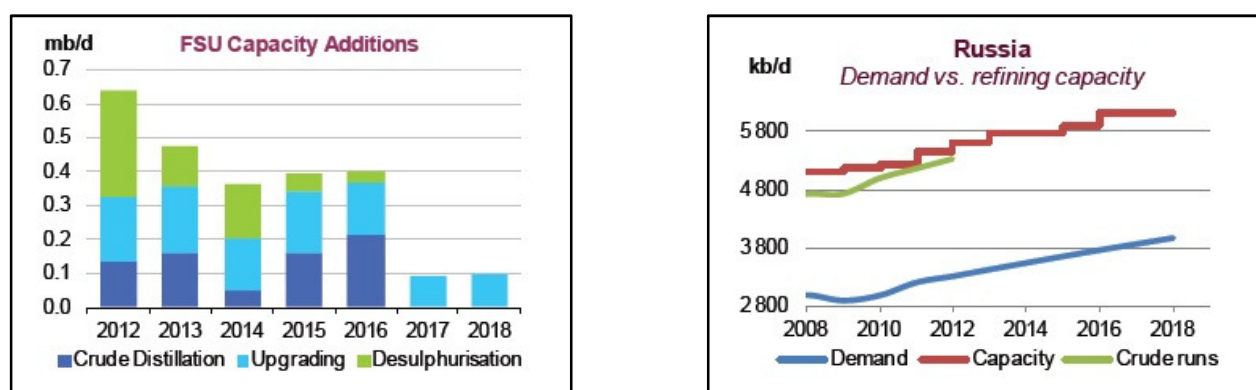


**Figure 10: Capacity additions by type in the FSU region (IEA, 2013b) and patterns of demand vs. capacity additions in Russia (IEA, 2013b).**

Hence, Russian refineries are underway to becoming more sophisticated and to increasing their technological competitiveness and as it can be seen in Figure 10, it is forecasted that investments in new capacity, in upgrading and in desulphurization units will continue at least until 2016/2018. According to the IEA (2013b) the modernization plan of the Russian government and the refiners includes the construction or upgrading of 15 secondary processing refinery units, which will be mainly isomerization units, FCC gasoline hydrodesulphurization, hydrocrackers and diesel hydro-desulphurization. All these units will help increasing the export volumes of high quality products which will be meeting the technical and environmental standards on both the export and Russian markets. As an example, it is projected that low-sulphur diesel exports from Russia could rise up to 300 kb/d in the coming years, with the destination markets being Northern Europe, Turkey and Mediterranean region.

It is therefore obvious that the European refining sector should be prepared to face increasing competition from its Russian counterpart in the near future, not only in the European diesel market, but also in other oil products export markets. Last but not least, it should not be neglected that Russian refineries are enjoying significant locational advantages related to governmental support, access to cheap crude oil feedstock and to cheap financing due to oil and gas export revenues. All these factors facilitate investments in Russian refineries and increase their cost-competitiveness towards European refineries (Meijknecht, Correljé, & van Holk, 2012). Therefore, it is expected that competition from Russian refineries will (and should) become a serious consideration for the European refining industry.

## Middle East and Asia

The third major source of competition for the European refining sector comes mainly from the Middle East and to a lesser extent from certain Asian countries such as India and China. The focus will first be on Middle East where several new and complex refineries have been already commissioned or are planned to be constructed in the near future.

### Middle East

Europe is a mature market, but in other regions such as the Middle East, domestic demand for specific oil products is growing rapidly and it almost outpaced existing refining capacity over the previous years. This in turn has led to serious investments in the refining sector of many of the countries located in this region (Bosoni & IEA, 2013); (Boncourt, 2013); (Fattouh & Mallinson, 2013). Oil producers in several countries of the GCC (Gulf Cooperation Council) were forced to proceed in these investments, as the excessive domestic demand for gasoline and diesel necessitated increased imports of these expensive oil products. Apart from this reason, other important considerations led refiners in those countries to proceed to investments, such as strategies towards integrating refineries with petrochemical plants or strategies for maximizing the yield of high-value products, for producing cleaner fuels which are complying to new environmental regulations, and lastly for reconfiguring refineries to changing patterns in oil product demand (Fattouh & Mallinson, 2013).

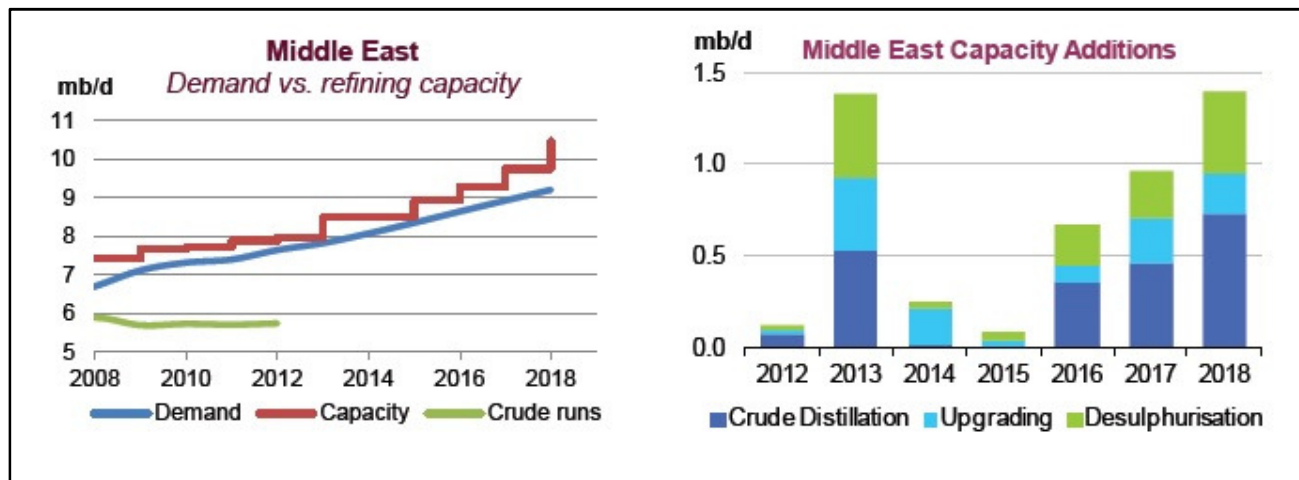


Figure 11: Patterns of demand vs. capacity additions in the Middle East and capacity additions by type in the region (IEA, 2013b).

The previous figure reveals a significant expansion of the refining capacity in Middle East over the period 2008-2013 and this trend is expected to continue, as more than 2.5 mb/d of crude capacity is expected to be commissioned during the 2013-2018 period. Most of these expansion investments are expected to take place in Saudi Arabia, and to a lesser extent in Qatar, Iran, Iraq and Oman (IEA, 2013b). Moreover, significant upgrading investments are expected to occur, in an effort to increase production of fuels of a higher quality. According to the IEA (2013b), most of the new upgrading projects will take place in Kuwait, Iran and Oman, and will consequently increase the upgrading ratio from 26% in 2012 to 37% in 2018.

It is obvious therefore that in Middle East there is a great amount of new highly-complex refining units installed. However, the projected overcapacity and low current utilization rates (74% on average over the period 2008-2013) are highlighting that many of these new complex and large refineries will be export oriented (Meijknecht, Correljé, & van Holk, 2012); (IEA, 2013b). Furthermore, it is expected that Middle Eastern refiners will significantly increase the production of diesel, which will be mainly exported to regions such as Europe. It is noteworthy that high-quality diesel production, only from the refineries located at the GCC countries, will almost double from 1.1 mb/d in 2012 to 2 mb/d in 2018, as it is illustrated in the following figure (Fattouh & Mallinson, 2013).

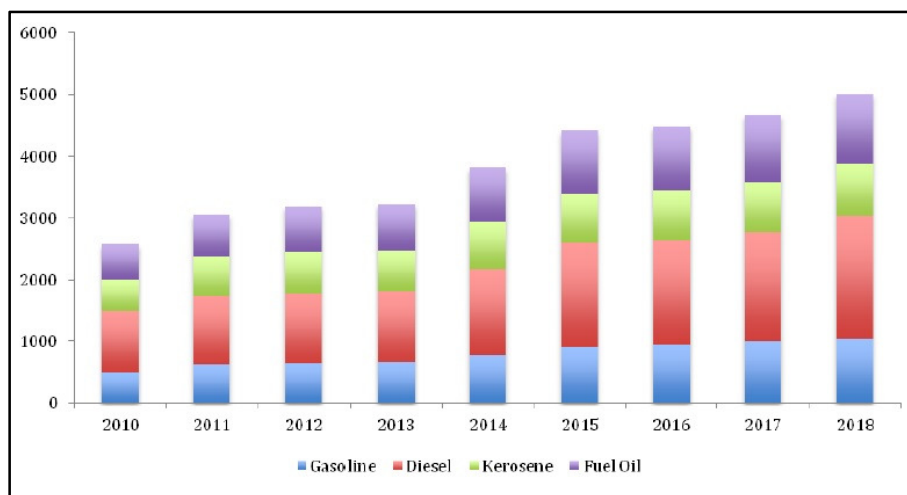


Figure 12: Evolution of GCC refining capacity by product (kb/d) (Fattouh & Mallinson, 2013).

Even more interesting is the fact that the amount of high-quality diesel which is expected to be exported mostly in Europe, is projected to increase four-fold between 2012-2018 (Fattouh & Mallinson, 2013).

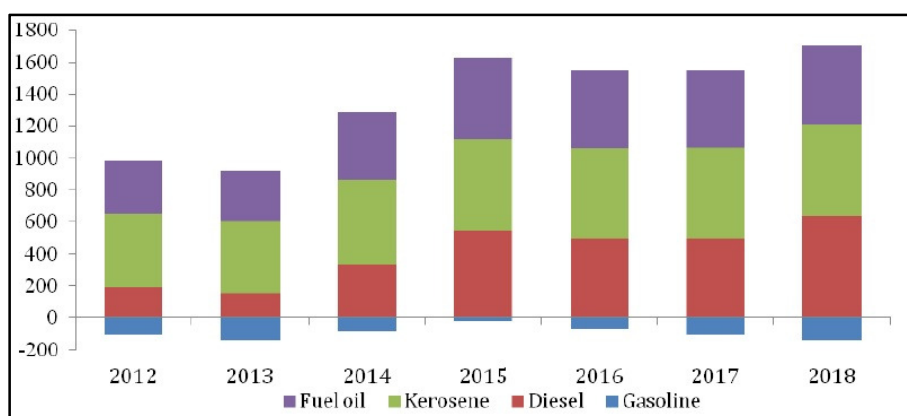


Figure 13: GCC net petroleum product flows (kb/d) (Fattouh & Mallinson, 2013).

All these developments highlight the serious competition the European refining sector is facing and will keep facing from refiners in the Middle East, in three ways. At first, European refiners have a significant share of the gasoline market in Middle East and they are currently exporting several oil products to countries such as Saudi Arabia. Once the expansion of the refining sector in Middle East will have been completed, the import flows in the region will be reduced and this will be a hard hit for the European refining sector (IEA, 2013b). Moreover, the increased future production of high quality fuels from new refineries in the Middle East will be diverted also to other export markets such as US, Africa and Latin America, where Europe's refiners will see their market shares being eroded. Last but not least, the ultra-low sulphur diesel production of Middle Eastern refineries is projected to increase significantly and the vast majority is expected to start reaching the European market, hence imposing more competition for European refiners in their domestic market (Oil and Energy Trends, 2013).

The problems for European refiners are exacerbated from the fact that many of them are old, less sophisticated and of a smaller scale compared to the new refineries in the Middle East. The latter are (and will be) of a larger size thus experiencing higher economies of scale, of a higher complexity thus able to cope better with demand fluctuations, and finally are being built to process a wider variety of crude oil imports which offers them more flexibility (KPMG, 2012). All these characteristics increase the cost-competitiveness of refineries in the Middle-East compared to the European ones, which in turn enable the former to offer oil products of a lower cost than the latter and thus gain market share. Additionally, refineries in the Middle East enjoy the benefits of having low operating costs, having access to cheap feedstock contracts from the upstream divisions of their National Oil Companies, having access to cheap credit sources of the public sector and finally, having strong governmental support. The combination of all of these factors constitute Middle Eastern refineries capable of supplying the European market with high quality fuels in low prices, as the higher freight cost for transporting these products to Europe is compensated by the low production cost (Meijknecht, Correljé, & van Holk, 2012).

## China

The Chinese refining sector is characterized by significant investments in new capacity, mainly because of an increasing domestic demand for oil products. According to the IEA (2013b), the Chinese refining industry crude distillation capacity reached 13.41 mb/d by the end of 2012, with significant investments projected for the upcoming years and especially 2015 and 2016.

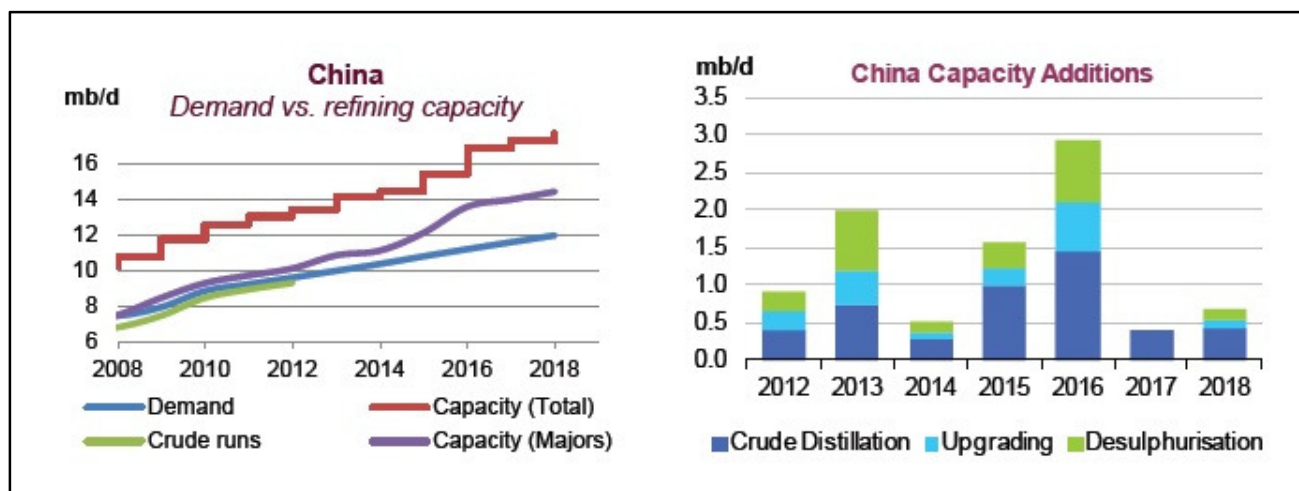


Figure 14: Patterns of demand vs. capacity additions in China and capacity additions by type in the region (IEA, 2013b).

The previous figures highlight that indeed there have been significant investments in the Chinese refining sector and are more to come. However, demand for oil products is following a similar pattern which practically means that production will mainly be absorbed by the domestic market (Meijknecht, Correljé, & van Holk, 2012). In this sense, Chinese oil products are not so likely to pose direct competition to European fuel exports. Even more so, the Chinese refining sector aims to export oil products to the Asian market, which is not a traditional export market for European refiners. Nevertheless, the massive increase in refining capacity in China has led to increased product exports such as diesel. This is accompanied by an effort to rationalize the economy by shifting domestic consumption of oil products away from energy-intensive exports, which has resulted in a declining

domestic demand growth for diesel. The previous development, combined with the rise in refining capacity has constituted China a net exporter of diesel in 2013 and these trends are forecasted to continue for the next two to three years (Fattouh & Mallinson, 2013). Therefore, even though Chinese oil products exports are not likely to compete directly with exports from Europe, it still remains to be seen how the global markets will react to these new developments, and if there will be an indirect impact on the market shares of European refiners across the global markets.

## India

India is a bit different case than China and the competition for European refiners from that part of the world is more significant. There have been significant investments in the Indian refining sector during the previous years, as a result of the ambition of the Indian government to constitute the country a major exporting hub of oil products (Meijknecht, Correljé, & van Holk, 2012). Subsequently, a large part of the refining capacity in the country has been deliberately designed for exports of oil products purposes (Boncourt, 2013).

According to data from the IEA (2013b), the refinery capacity in India reached almost 4.4 mb/d by the end of 2012, with crude runs being at 4.3 mb/d. The total capacity increased 10% only in 2012, with projects enabling the production of high quality fuels meeting the Euro IV and V specifications. Indian refineries are capable in general to produce high-level products such as high-octane gasoline, ultra-low sulphur diesel and Petcoke (Meijknecht, Correljé, & van Holk, 2012). Concerning future investments, the majority of refining capacity addition is expected to occur between 2013 and 2014, with 420 kb/d installed, while total capacity is expected to reach 4.8 mb/d in 2018 (IEA, 2013b).

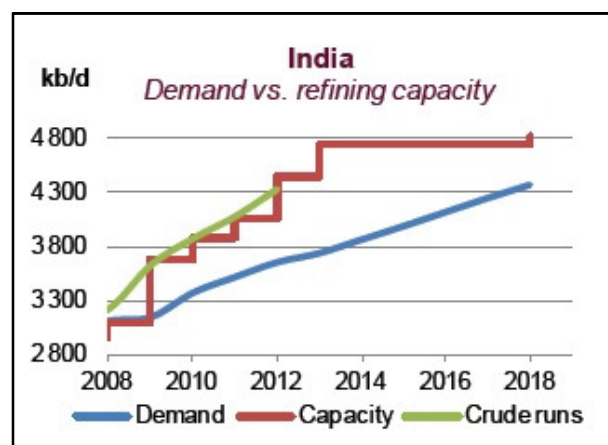


Figure 15: Patterns of demand vs. capacity additions in India (IEA, 2013b).

Indeed a significant amount of production is already exported as in 2012, for example, almost 700 kb/d of oil products have been finding their way in export markets, and the trend of increased exports is expected to continue (Fattouh & Mallinson, 2013). Even though the largest percentage of these exports is destined for countries located in the Indian Ocean region, a significant amount is reaching Europe (Meijknecht, Correljé, & van Holk, 2012). This is particularly the case for diesel exports, as in the beginning of 2013 India's net diesel exports reached 0.4 - 0.55 mb/d, with the main destinations being Europe and Africa (Fattouh & Mallinson, 2013).

To conclude, the case of India has some similarities with the case of China, where increasing demand for oil products is a major driver for investments in refining capacity and upgrading units. Nevertheless, a main difference is that many of the new refining capacity in India is export oriented, which means that future exports of oil products are projected to increase. Taking into consideration that Indian refineries are capable of producing high quality fuels, it is expected to notice increasing competition for the

European refining sector from this part of the world, not only in the European diesel market, but also in other export markets for gasoline worldwide.

To summarize, the new refineries in Middle East, India and China, are expected to pose serious competition for the European refining sector, not only in the European market, but also in export markets outside Europe (Oil and Energy Trends, 2014). Undoubtedly, the most important pressures for European refiners come from Middle East, with the effects of competition from this region being already visible in Europe. Nevertheless, it may be the case that the situation will deteriorate for European refiners, if countries such as India and China will keep or will start exporting large volumes of their products in global markets.

### Refining overcapacity in Europe coupled with low crude runs

The previous paragraphs introduced the issues of decreasing demand for oil products in Europe, of the imbalances between supply and demand for gasoline and diesel in the European market, as well as of the increasing competition European refiners face from the US, Russia, Middle East and Asia. All these developments and trends have put the European refining industry at a disadvantaged position but there are also other important elements painting a bleak picture for the future of this industry. The first factor to be discussed is the current refining overcapacity in Europe. This issue of course is directly connected to the low levels of demand for oil products, as declining demand especially after 2008 and the downturn of European economies, has led to significant spare refining capacity in Europe. This is better illustrated in the following figure, which reveals how the environment deteriorated for European refiners after 2008, with drastically declining crude throughputs leading to a utilization rate of about 80% in 2012 (FuelsEurope, 2014).

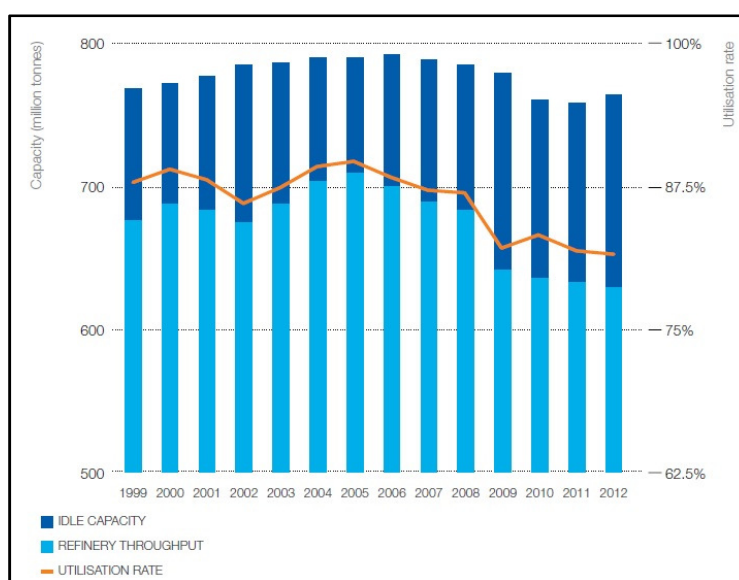


**Figure 16: Capacity and utilization of European refineries (FuelsEurope, 2014); (Based on data from BP Statistical Review of World Energy 2013).**

However, the situation worsened even more after 2012, as utilization rates fell by the end of 2013 to approximately 78% (BP, 2014). It is worth mentioning that a utilization rate of above 85% is usually

considered the threshold for cost-efficient operation of a refinery (FuelsEurope, 2014) and in other words, low utilization rates are directly connected to low profitability of refineries. This put many small-scale and unsophisticated European refineries under significant pressure the previous years and as it will be elaborated in a subsequent paragraph, their profitability was further hit by extremely thin or even negative refining margins. Consequently, much of the spare refining capacity had to shut down and indeed Europe has experienced significant reductions in its refining capacity over the last years.

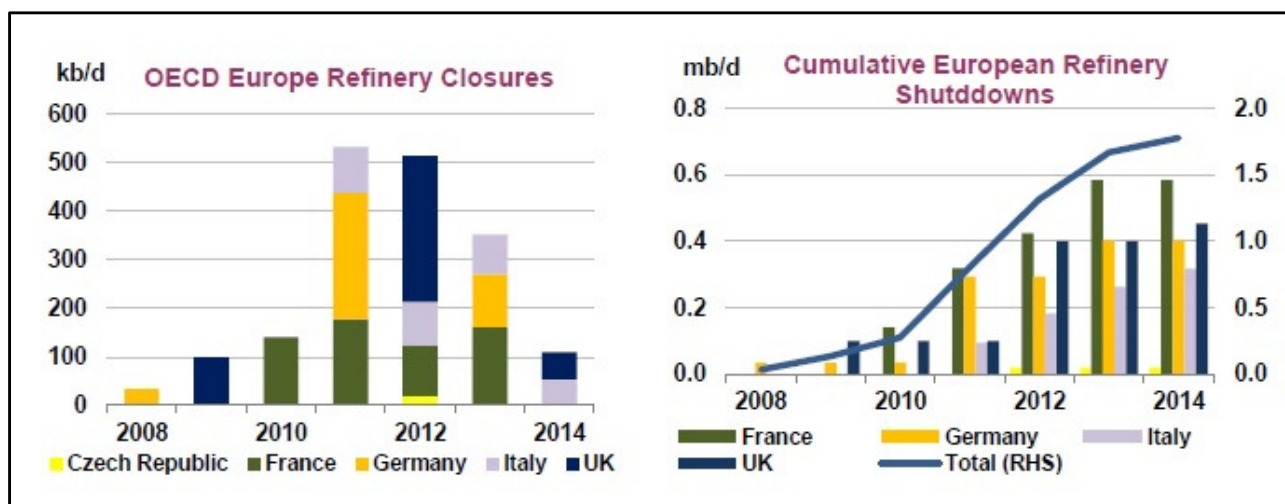


Figure 17: Refining capacity closures in OECD Europe per year and cumulative (Bosoni & IEA, 2014).

According to data from the IEA (IEA, 2013b); (Bosoni & IEA, 2013); (Bosoni & IEA, 2014), 15 refineries have been closed from 2007 to 2013 in OECD Europe of a total capacity of 1.7 mb/d and another 110 kb/d of capacity are expected to close in 2014. Most of the capacity reduction over the period 2008-2014 will have taken place in France (585 kb/d), Germany (400 kb/d), UK (455 kb/d) and Italy (320 kb/d) (Bosoni & IEA, 2014). Moreover, refinery closures also took place in Czech Republic, Ukraine and Romania, as it can be noticed in the following figure which shows all closures of European refineries, since 2008.

| Refinery              | Owner          | Capacity ('000 b/d) | Status               | Period            |
|-----------------------|----------------|---------------------|----------------------|-------------------|
| <b>Italy</b>          |                |                     |                      |                   |
| Mantova               | MOL            | 55                  | To close permanently | January 2014      |
| Gela                  | Eni            | 105                 | 10 month closure     | June 12-April 13  |
| Rome                  | TotalErg       | 86                  | Permanent closure    | September 2012    |
| Falconara             | API            | 83                  | 6 month closure      | January-June 2013 |
| Cremona               | Tamoil         | 90                  | Permanent closure    | October 2011      |
| Porto Marghera        | Eni            | 80                  | Permanent closure    | Q3 2013           |
| <b>France</b>         |                |                     |                      |                   |
| Petit Couronne        | Petroplus      | 162                 | Permanent closure    | December 2012     |
| Reichstett            | Petroplus      | 85                  | Permanent closure    | November 2010     |
| Berre l'Etang         | LyondellBasell | 105                 | Mothballed           | January 2012      |
| Dunkirk               | Total          | 140                 | Permanent closure    | September 2009    |
| <b>Germany</b>        |                |                     |                      |                   |
| Harburg               | Shell          | 110                 | Permanent closure    | April 2013        |
| Wilhelmshaven         | Hestia Energy  | 260                 | Permanent closure    | October 2009      |
| <b>UK</b>             |                |                     |                      |                   |
| Coryton               | Petroplus      | 220                 | Permanent closure    | July 2012         |
| Teesside              | Petroplus      | 117                 | Permanent closure    | May 2009          |
| <b>Romania</b>        |                |                     |                      |                   |
| Arpechim              | Petrom         | 70                  | Permanent closure    | January 2012      |
| <b>Czech Republic</b> |                |                     |                      |                   |
| Paramo                | Unipetrol      | 20                  | Permanent closure    | May 2012          |
| <b>Ukraine</b>        |                |                     |                      |                   |
| Lisichansk            | Rosneft        | 160                 | Indefinite closure   | March 2012        |

Figure 18: European refinery closures since 2008 (Elliot, 2013).

For 2014, the closure of MOL's Mantova refinery in Italy has already been announced and Essar is planning to reduce the capacity of its Stanlow refinery in UK (Bosoni & IEA, 2014). Overcapacity remains though, thus this trend of capacity closures is likely to continue for many more years. According to IEA (2013b); (2013a) more closures should be expected (a further 900 kb/d of European refining capacity is at risk of closure) and while in the end of 2012 crude oil distillation capacity in OECD Europe constituted approximately 16% of the world total, the further closures of European refineries alongside with the capacity additions in other regions of the world will decrease this share to 14% by 2018.

A major reason explaining why further capacity closures are inevitable in Europe, is that demand for oil products in the region had an even steeper decline over the recent years (IEA, 2013a). Therefore, despite of the significant contraction of refinery capacity (1.7 mb/d) for the period 2008-2013, demand fell almost 1.9 mb/d during the same time frame, forcing the utilization rates to remain low or to drop even further. This is the principal reason that capacity closures up-to-date did not result in higher refinery throughputs, which would increase the profitability of European refiners.

On top of these developments comes the fact that although there is a nominal surplus of distillation capacity in Europe, there is at the same time a deficit of upgrading capacity for the production of middle distillates (Oil and Energy Trends, 2013); (IEA, 2013b). The main repercussion of this situation has already been discussed; the inability of European refineries to provide their domestic markets with middle distillates has led to the increased import flows of these products from the US, Middle East and Russia.

Simply put, many refineries in Europe are simple hydroskimming plants, unable to produce the middle distillates the market demands. These refineries are inevitably facing the greatest pressures, as their product slate has reduced flexibility and it cannot respond to market demand fluctuations. Thus, this type of plants in Europe, are confronted with inability to produce diesel and other middle distillates and with increasing difficulties to sell their gasoline production in the global markets. It is worth mentioning that even though most of the capacity closures, so far, concerned this type of refineries, in 2012 these plants still constituted the majority. According to the IEA (2013b), in 2012 approximately 39% of OECD Europe's distillation capacity concerned conversion refineries, with the remaining 61% representing simple refineries of a total capacity of 620 kb/d. However, more of the hydroskimming refineries are about to close in the future, and the forecasts state that in 2018 the share of complex refineries will have increased to 41% (IEA, 2013b); (Oil and Energy Trends, 2013).

Of course shutting down simple refineries is not the only option, as alternative solutions for operators are either to invest in these refineries and to transform them to complex plants or to sell them. For the latter solution, the author of the thesis elaborates in Chapter 2 of the report about the changing ownership structures in the European refining sector. For the former solution, it should be mentioned that undertaking investments in upgrading and desulphurization units requires significant capital expenditures and significant lead times, so it is not an easy call for all refiners to proceed with this solution. Nevertheless, it may be the only option for staying in the refining business in Europe and indeed, there are some European refiners who have already undertaken this kind of investments or are planning to.

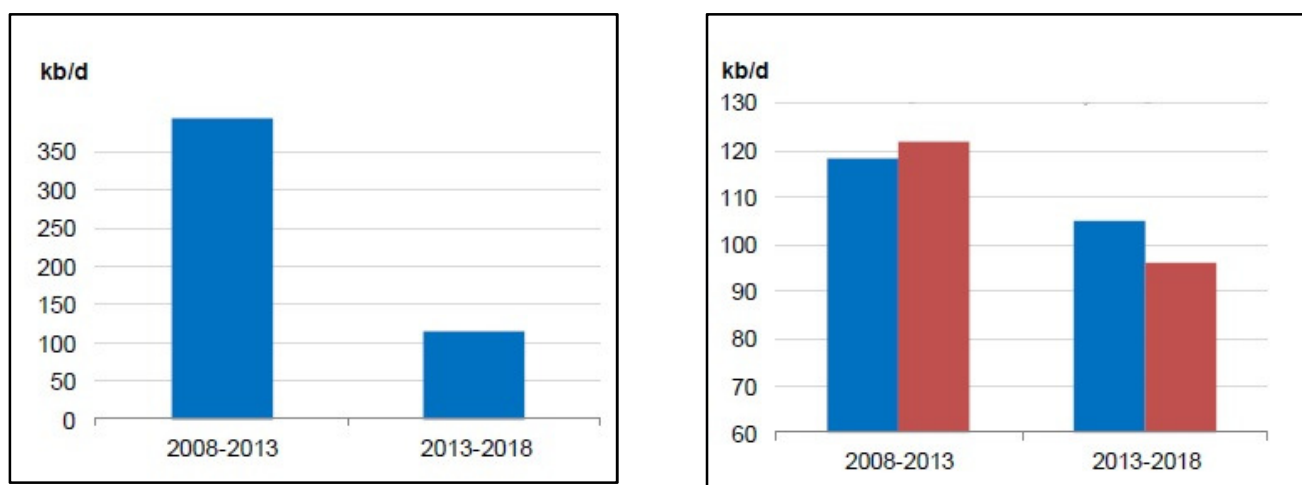


**Figure 19: Hydrocracking capacity additions in Europe (IEA, 2013a). Coking (blue) and diesel desulphurization (red) capacity additions in Europe (IEA, 2013a).**

According to statistical data from the IEA (2013a), over the period from 2008 to 2013, hydrocracking capacity and coking capacity in the EU increased by 29% and 34% respectively, and these trends are also set to continue in the future as it is illustrated in the previous figures.

It should be mentioned, though, that the situation with respect to investments varies significantly among different European regions. Over the period 2008-2012, refining capacity declined significantly in France (-25%), Germany (-11.4%), UK (-10.7%) and Italy (-8.2%), while in countries such as Spain, Greece, Belgium and Sweden total capacity increased. These discrepancies among European countries exist also when it comes to investments in conversion capacity, with many refineries especially in

Southern European countries being upgraded (Oil and Energy Trends, 2013); (IEA, 2013b). A major reason for these differentiations is the differences between the refining capacity and its configuration, among European countries.

According to the IEA (2013b), almost two thirds of European countries exhibit a crude distillation overcapacity, with the remaining one-third having apart from overcapacity, a refining sector of low complexity (expressed by the Nelson complexity factor in Figure 20). Furthermore, differences among countries also exist with respect to their domestic demand patterns (more gasoline or diesel required). Even though these differences are not underestimated by the author of this thesis, it is nevertheless out of the scope of this research to analyze separately the situation in different European countries. On the contrary, the analysis will remain focused on the whole region, as a general pan-European point of view is adopted throughout this report.

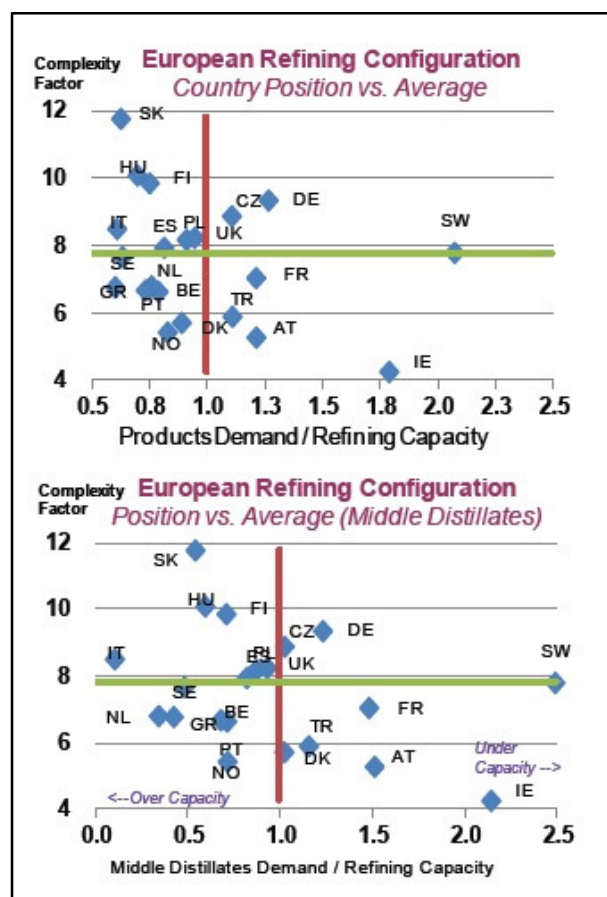


Figure 20: Configuration characteristics of European refineries (IEA, 2013b).

### Thin refining margins and high operating costs

The importance of proceeding in upgrading or desulphurization investments in European refineries has already been highlighted. However, the cost of these types of investments is high and profitability of many European refineries has been hit hard over the last years, as refining margins have been extremely low. This is of course the case mostly for simple refineries, which are not able to adjust their production according to what the market demands. Nevertheless, first there is a need to explain what is meant with the phrase "refining margins".

Refining margin refers to the difference between the price for which the oil products a refinery produces can be sold, and the price paid for acquiring the crude oil from which these products were refined. Refining margin takes also into account the operating cost of a refinery and hence, refining margins are a good indication of the profitability of a refinery, with high margins suggesting increased profitability.

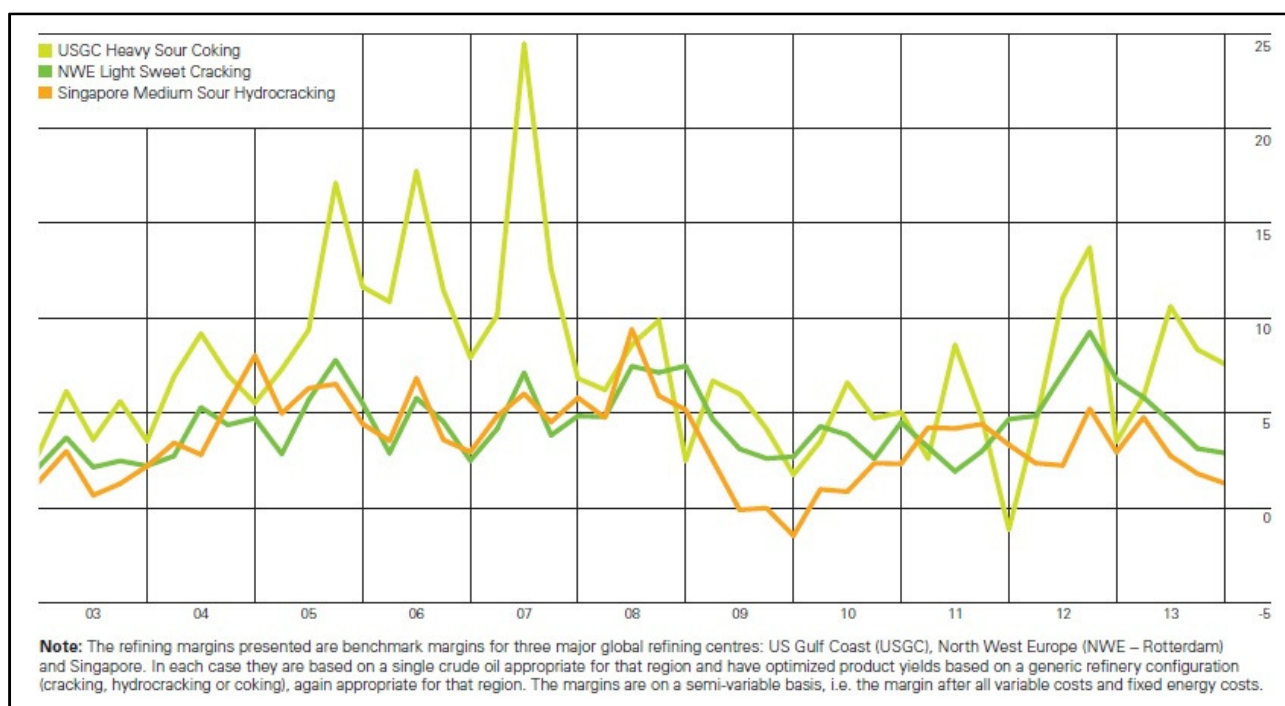


Figure 21: Regional refining margins (US \$/barrel) (BP, 2014).

The previous figure shows the movements of benchmark refining margins for three major global refining centers; US Gulf Coast (USGC), North West Europe (NWE – Rotterdam) and Singapore. It can be easily noticed that refining margins in Europe have been quite low especially after 2008. Moreover, the impact of shale oil and gas revolution on the profitability of US refiners can also be identified, as US refiners are enjoying in principle better margins than their European counterparts. Moreover, the next two figures showcase in more details how refining margins have been shifting up and down in different regions of Europe, with, nevertheless, a clear downward trend illustrated after 2008.

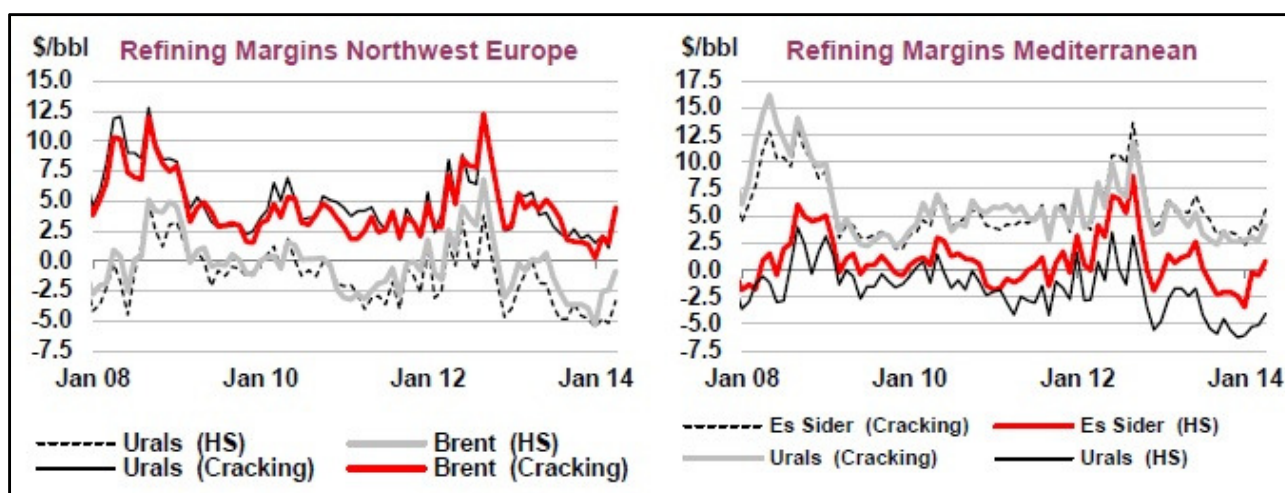


Figure 22: Refining margins in Northwest Europe and in the Mediterranean region (Bosoni & IEA, 2014).

The only year in which European refineries saw their margins improving was 2012 and the reason behind this amelioration was the large number of plants which shut down their operation that year, which in turn decreased refining capacity in Europe (Blas, 2012). However, this improvement did not last and low refining margins returned after 2012, both in Northwestern Europe and Southern Europe. The two previous figures also reveal that, over the period 2006-2013, refining margins were significantly lower for simple hydroskimming refineries (HS) than for more complex refineries with conversion (cracking) units, while in some cases simple refineries experienced even negative margins (operating at a loss). As a matter of fact, refining margins for simple refineries have been negative through most of 2013 (Bosoni & IEA, 2014). The reason for this difference has already been mentioned and it has to do with the inability of simple refineries to produce higher value products, such as middle distillates, which did not allow them to benefit from the higher prices for diesel than for gasoline. On the other hand, refineries with conversion units were able to reconfigure their production slate and maximize production of higher value products, which in turn led to higher refining margins. Therefore, gasoline-heavy European refineries have been facing the greatest pressures on profitability over that period (especially from 2008 to 2012), as the refining spread between crude oil and gasoline prices has been quite tight (FuelsEurope, 2014).

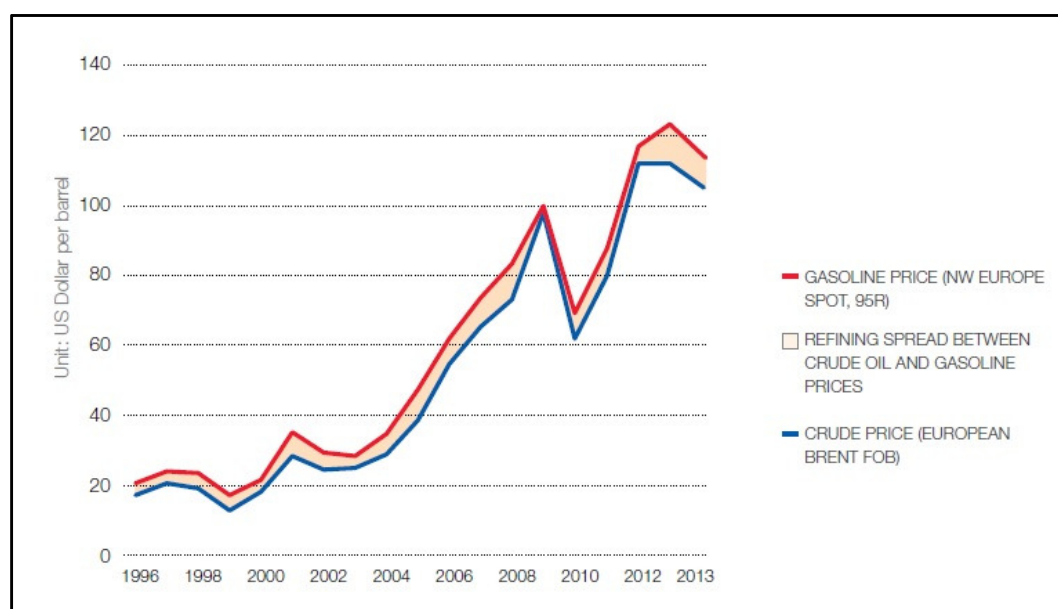


**Figure 23: Evolution of refining spread between crude oil and gasoline prices for European refineries (FuelsEurope, 2014); (Based on data from Wood Mackenzie).**

In order to calculate their refining margins and profitability, refiners have to deduct from the spread their operating costs. It should be stated that feedstock costs (or crude oil costs) are not part of the operating costs of a refinery. Nevertheless, feedstock costs obviously play an important role in determining refining margins and as it will be discussed in the next paragraph of this section, the cost of crude oil has risen significantly for many European refiners over the recent years.

To return to the importance of operating costs for European refiners, these costs come into the whole picture as a factor which has significantly affected the profitability of European refiners, namely their high operating costs. Operating costs include fixed and variable costs; the former includes manpower costs, maintenance costs, overhead costs and cost of capital, while the latter includes costs of chemicals

and other additives, costs of catalysts, fuel or otherwise called energy costs, and finally any other working capital charges (Fahim, Al-Sahhaf, & Elkilani, Refinery Economics, 2010).

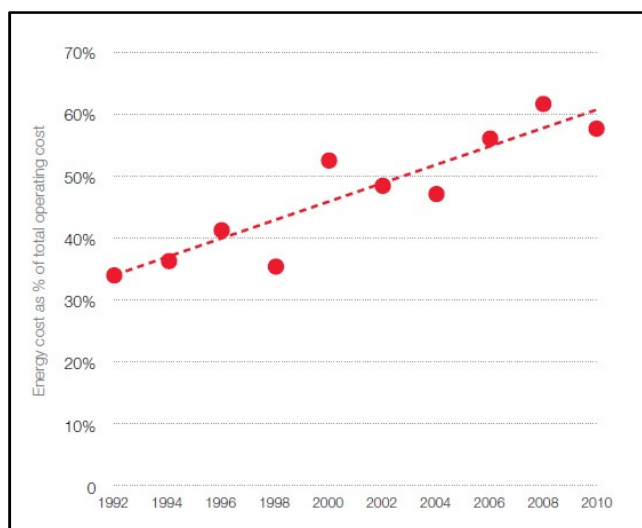


**Figure 24: EU refineries' energy cost as percentage of total cash operating costs (FuelsEurope, 2014); (Based on data from Solomon Associates).**

The energy costs is a very important element of the total operating costs and one of the reasons for the thin margins experienced by many European refiners, are the high energy costs. As it can be seen in the figure, the share of energy costs has increased significantly since 1992, reaching almost 60% in 2010. In 2012 energy costs represented more than 60% of the total energy costs according to the IEA (2013a), while CONCAWE has calculated a share of 63% for the same year (Nelson & CONCAWE, 2013).

It is worthwhile mentioning that the rise of energy costs for European refineries has taken place, despite the improvements in their energy efficiency by about 18% over the past 18 years (FuelsEurope, 2014). At the same time, energy costs fell significantly for the US refiners due to the shale oil and gas revolution. The significant competitive advantage for US refiners over EU refiners, with respect to their energy costs, is also highlighted from the fact that electricity prices for industry in the EU have risen almost 40% between 2005 and 2012, while the prices in the US have decreased by a few percent over the same period (FuelsEurope, 2014).

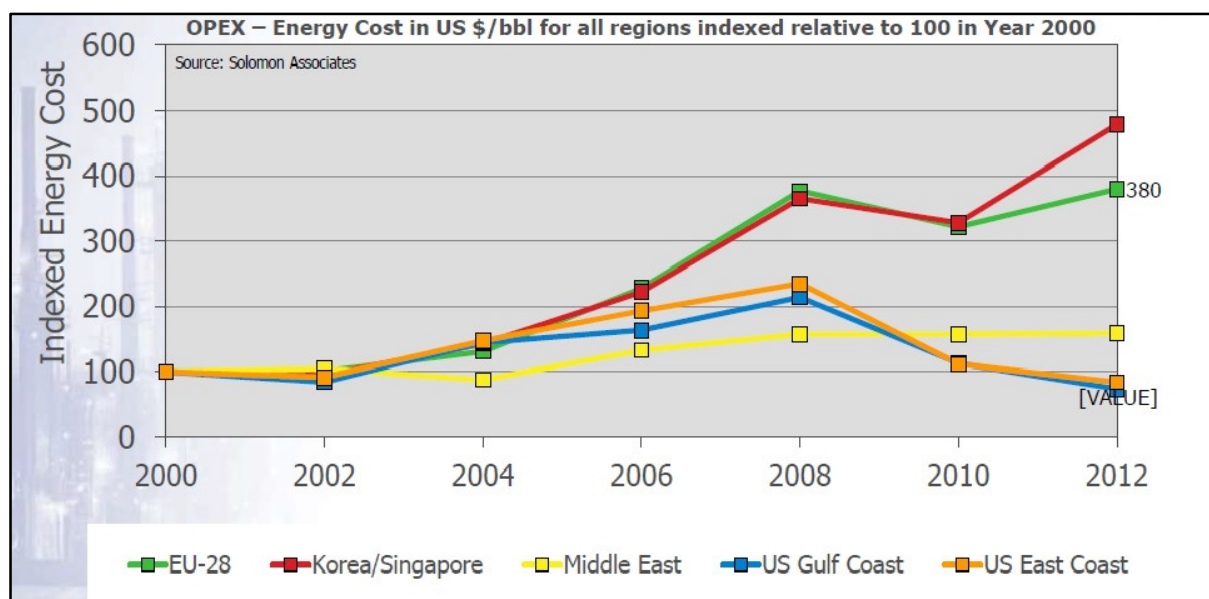


Figure 25: Evolution of energy costs for refineries across different regions (Nelson & CONCAWE, 2013); (Based on data from Solomon Associates).

According to statistical data of CONCAWE (Nelson & CONCAWE, 2013), while the share of energy costs for refineries in the EU-28 countries has risen from 52% of total operating costs in 2000 to 63% in 2012, the share for US Gulf Coast refiners has dropped from 52% to 28% over the same period. Moreover, energy costs for refineries in the Middle East are also significantly lower than for their European counterparts, due to the locational advantages which the former enjoy. These advantages were elaborated in the section referring to the increased competition the European refining sector is facing from Middle Eastern refineries. The impact of the different trends in energy costs is visible in the evolution of the total operating costs of refineries in these regions of the world, as illustrated in the following figure.

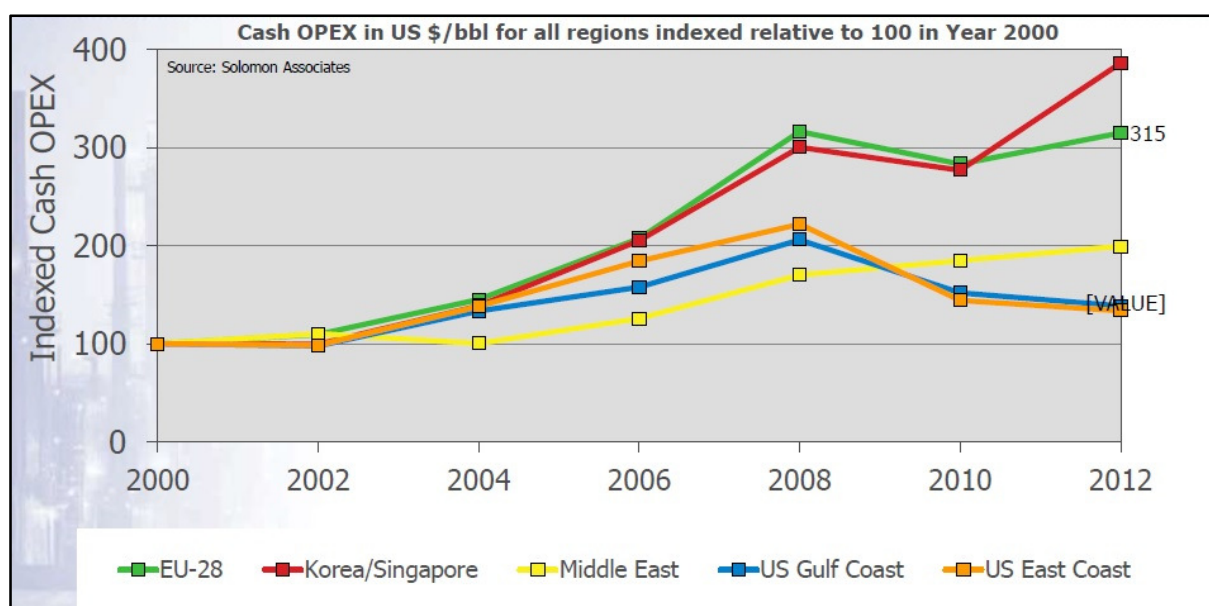


Figure 26: Evolution of operating costs for refineries across different regions (Nelson & CONCAWE, 2013); (Based on data from Solomon Associates).

It comes then as no surprise that with such high operating costs, the refining margins in Europe are extremely thin and consequently the profitability of European refineries has been decreasing over the last years. Moreover, it is obvious that it will be a serious challenge for the European refining sector to compete with its counterparts in the US and Middle East, especially considering that operating costs for refineries in Europe are not expected to improve through to 2020. What could rapidly change the situation would be the decline of energy costs due to benefits from the US shale gas revolution. However, this cannot become reality as long as US LNG gas exports are not allowed and as long as there are not operational terminals to handle these gas volumes (Nelson & CONCAWE, 2013).

The impact of European environmental legislation on the refining margins and profitability of European refiners is also of significant importance, but this topic will be discussed extensively in a subsequent paragraph.

### Changes in crude qualities and higher crude oil prices

The issue of the thin refining margins many European refineries have experienced especially after 2008, has been adequately discussed in the previous paragraphs, along with the high energy and operating costs in Europe compared to other regions of the world. What has not been discussed is that the operating margins and profitability have also been affected by the changing patterns of the different crude oil qualities which are reaching Europe as refinery feedstock.

Many European refineries have been initially designed to process light sweet crude oil qualities, similar to North Sea crude oil qualities. However, domestic crude oil production in Europe has declined significantly over the past decade, mainly as a result of the declining North Sea crude oil output (Meijknecht, Correljé, & van Holk, 2012); (Boncourt, 2013); (Cooper, S. & Wood Mackenzie, 2013). According to statistical data of Wood Mackenzie (2013), North Sea crude oil production accounted for 88% of total Europe's crude oil/ Natural Gas Liquids (NGL) production in 2012, while in 2000 this share was 93%.

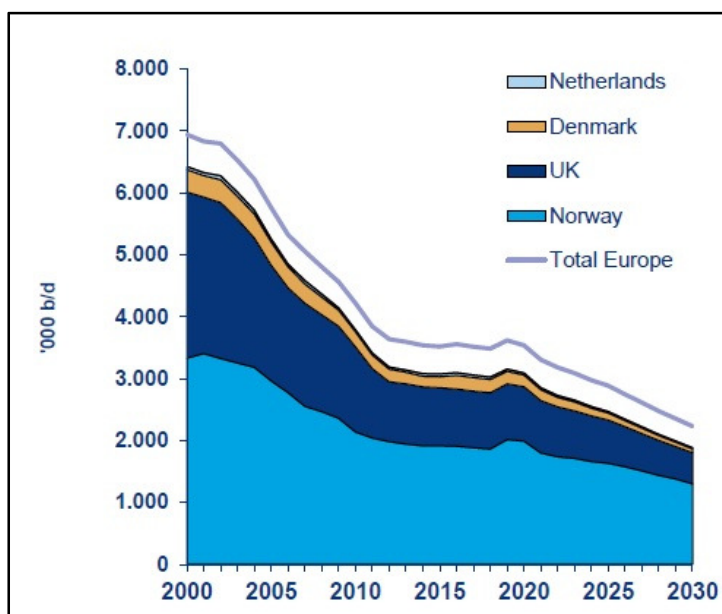


Figure 27: European crude oil production (Cooper, S. & Wood Mackenzie, 2013).

Although the projections show a further decline of North Sea production during the next 15 years, the rate of decline depends on new field discoveries or other developments in proximity with large and mature fields (Cooper, S. & Wood Mackenzie, 2013). Indeed, the IEA (2013b) considers that the declining rates will decrease as new fields are offsetting declining production, and forecasts are that from approximately 3.1 mb/d in 2012, crude production will end up to 2.9 mb/d in 2018. Most of these new fields have been discovered in UK, the second bigger producer in Europe after Norway, and are expected to lead to increased production rates for the period 2012-2018. On the contrary, Norway's production rates are expected to keep declining throughout the same period, although there will be improvements in recovery rates at existing fields and discoveries of new fields close to already-developed infrastructure, which can decrease the declining rate (Cooper, S. & Wood Mackenzie, 2013); (IEA, 2013b).

However, the direct implication of the declining indigenous oil production in Europe over the past and the future years, is that imports of crude oil produced in other regions of the world have been and, will keep, rising. According to Meijknecht et al. (2012), the two most prominent suppliers of crude oil to European refineries have been Russia with the Urals quality and Venezuela, with the Russian production having the lion's share. While the Urals quality has been mainly used as feestock in Western European refineries, the Caspian Pipeline Consortium (CPC) quality, which is also being produced in the region of Former Soviet Union, has been dominating the crude oil imports in Southern Europe.

Both of these two qualities though, have significantly different characteristics than the European qualities (North Sea qualities), as they are heavier (having a lower API) and they are substantially sourer, meaning they contain significantly more sulphur (Meijknecht, Correljé, & van Holk, 2012). Figure 28 illustrates the specific characteristics of the main European crude qualities and Figure 29 allows for comparisons with the qualitative characteristics of the main alternative crudes which are imported in Europe.

| <i>Main European<br/>crude qualities</i> |            |                |
|------------------------------------------|------------|----------------|
|                                          | <i>API</i> | <i>Sulphur</i> |
| <b>Denmark</b>                           |            |                |
| South Arne                               | 37.7       | 0.21%          |
| <b>Norway</b>                            |            |                |
| Oseberg                                  | 37.8       | 0.27%          |
| Ekofisk                                  | 37.2       | 0.23%          |
| Asgard                                   | 50.5       | 0.07%          |
| <b>UK</b>                                |            |                |
| Brent blend                              | 38.3       | 0.37%          |

**Figure 28: Characteristics of main European crude oil qualities (Meijknecht, Correljé, & van Holk, 2012); (Based on data from IEA, CIEP analysis).**

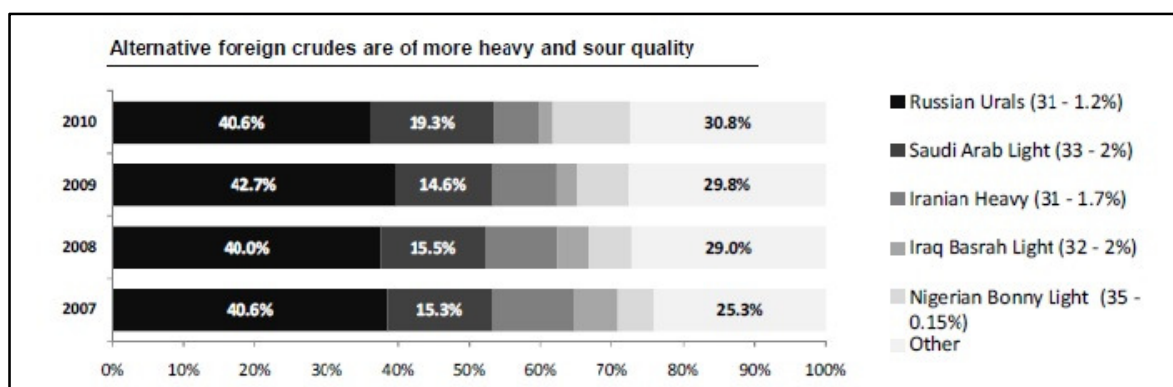


**Figure 29: Characteristics of alternative foreign crude oil qualities (Meijknecht, Correljé, & van Holk, 2012); (Based on data from IEA, CIEP analysis).**

However, not all refineries in Europe have been able over the past years, to process these new heavier and sourer crude qualities, as conversion and desulphurization units are required. Taking into consideration that European legislation has set high standards with respect to oil fuels production, with ultra-low sulphur content and low CO<sub>2</sub> emissions becoming serious requirements, the pressure on refiners to invest in conversion and desulphurization units was even higher (Meijknecht, Correljé, & van Holk, 2012). As it was already discussed, many European refineries did not possess these units and the lack of investments has constituted them unable to use these new crude qualities. This has been translated to an increased demand for light and sweet crude qualities, which in turn made them being traded at a premium, while the abundance of heavier and sourer qualities made them being traded at a discount. Consequently, the European refiners who could not use the cheaper feedstocks or could not proceed to the required investments in upgrading their plants, saw their refining margins being eroded, as they have had to rely on expensive crude qualities for their production. On the other hand, European refineries complex enough to switch their crude slate towards these new crude qualities, have been benefiting greatly from the price differentials between the light/sweet and heavy/sour crudes. Competitors of European refineries in other regions of the world, such as the Middle East, have also managed to exploit similar price differentials, due to the complexity of their plants, and to see their refining margins increasing over the past years (Meijknecht, Correljé, & van Holk, 2012).

Although the aforementioned developments in supply of crude oil to European refineries took place over the past years, the future expectations (up to 2030) are that there will be a decline in indigenous crude production in Europe, but this will be accompanied by an increasing share of heavy qualities in the production mix. However, the average sulphur content of European crude is anticipated to remain unchanged in principle (Cooper, S. & Wood Mackenzie, 2013).

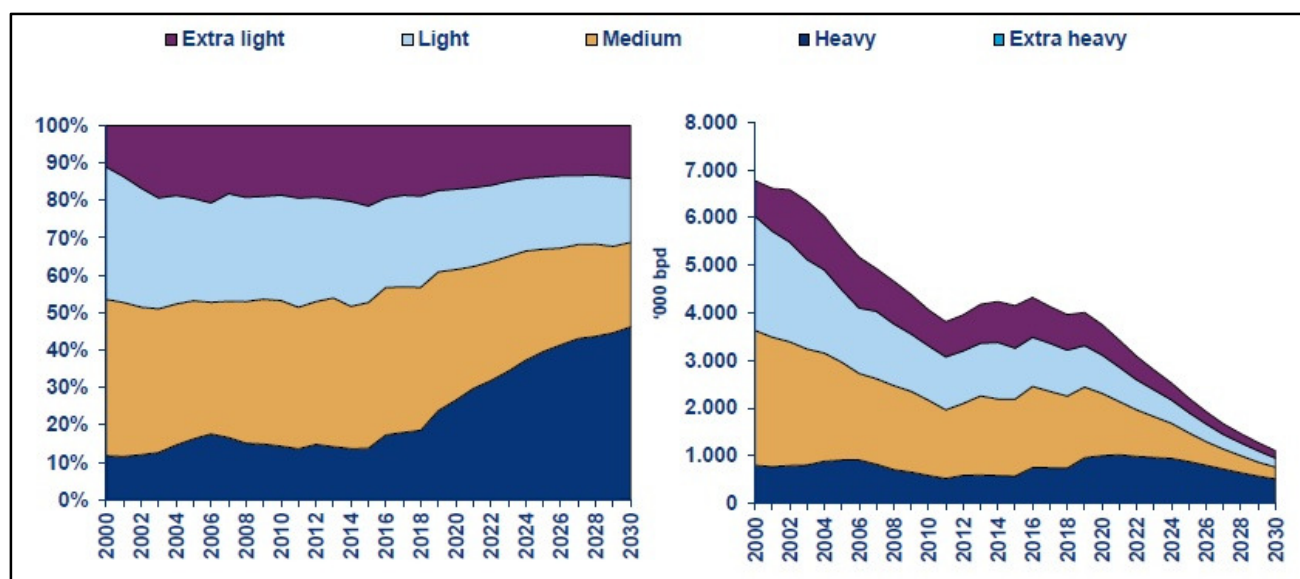


Figure 30: European crude oil production in proportional terms and in volume terms (Note: does not include forecast crude volumes / commercial adjustments of unknown quality) (Cooper, S. & Wood Mackenzie, 2013).

In the short run (until 2018), there will be an increase in the shares of Russian, North African and Caspian crude which will be imported in Europe, while the opposite is likely to happen for the shares of Middle Eastern and West African crudes due to the increased demand for crude in the Asian market. It is noteworthy to mention that European crude oil production will remain relatively stable until 2018, with significant declining rates emerging after 2018. Moreover, the European crude slate is not expected to change dramatically in terms of quality, with only a small shift towards slightly heavier and sweeter crudes expected (Cooper, S. & Wood Mackenzie, 2013).

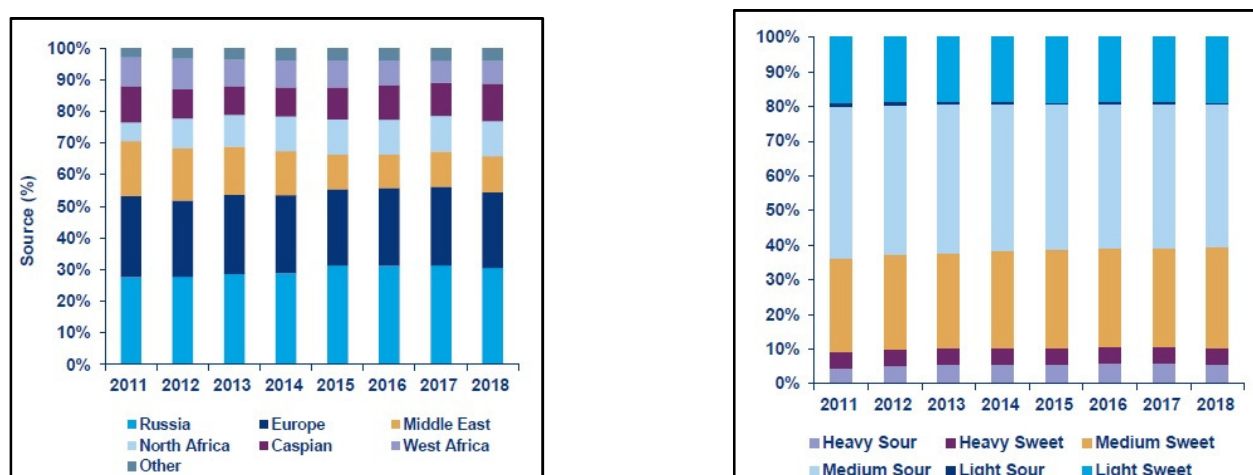


Figure 31: European crude slate by source and by quality respectively (Cooper, S. & Wood Mackenzie, 2013).

Concerning the years after 2018, the declining shares of European and Russian crude oil in the total mix, will be compensated by increased Caspian and Middle Eastern imports (Cooper, S. & Wood Mackenzie, 2013).

To conclude for this section, many simple European refineries felt the impact of the new crude qualities reaching Europe as feedstock, as they saw their refining margins decreasing while their competitors in other regions were benefiting from the price differentials created between the different crude oil qualities. Therefore, these trends did also contribute significantly to the loss of profitability and pressure the European refining sector has been experiencing over the past years. Concerning the future, it seems that the current mix of crude oil reaching European refineries is likely to remain the same, however with small shifts towards heavier crudes. This means that if European refiners want to increase their margins and remain in the business, it is necessary to proceed to investments in conversion and desulphurization units, which will enable them to exploit favorable crude oil prices and to produce oil products meeting the increasingly stringent mandates of environmental legislation.

### European regulatory framework considerations

One of the key factors which have affected the profitability of many European refineries is the regulatory framework in the EU. Indeed, there has been an increasing number of EU regulations on health, safety and environment over the previous years, and to highlight this trend, it is worth mentioning that the cumulative number of these regulations has almost doubled from 2004 (940 regulations) to 2012 (1724 regulations). Of course, it is unquestionable that many of these legislations have benefitted the citizens of EU, however this happened at a cost for the refining industry due to the increased complexity these legislations brought into the picture (FuelsEurope, 2014).

The previous considerations led to pressures by the European refining industry to the European Commission, which in 2012 made the decision to perform the so-called “Fitness Checks” in order to assess the impact of EU legislation on different industries, in terms of competitiveness, jobs and growth. The European refining industry was one of the industries which were selected for investigation and the refining fitness check was initiated. The goals of this fitness check are to reveal how coherent and consistent is the sum of EU legislations and to lead to identification of the efficiency and effectiveness of EU legislation, of any excessive burdens for the industry, of overlaps, gaps or inconsistencies among regulations and of other obsolete regulations. Moreover, realistic solutions are also supposed to be proposed for the legislation-related problems of the European refining industry. The fitness check will involve quantitative and qualitative assessment of the impact of the regulations on the European refining industry, and the results are expected to be available at August or September 2014 (FuelsEurope, 2013). The basic regulatory framework which was decided to be included in the assessment, consists of the following EU regulations: (1) the Emission Trading System Directive (EU ETS), (2) the Air Quality Directive (AQD), (3) the Marine Fuels Directive (MFD), (4) the Strategic Oil Stock Directive (SOSD), (5) the Fuels Quality Directive (FQD), (6) the Energy Taxation Directive (ETD), (7) the Clean and Efficient Vehicles Directive (CEVD), (8) the Renewable Energy Directive (RED), (9) the Energy Efficiency Directive (EED) and finally, (10) the Industrial Emissions Directive (IED), the Integrated Pollution Prevention and Control Directive (IPPC) and the Large Combustion Plants Directive (LCPD) (EC JRC-IPTS, 2014) (FuelsEurope, 2013).

It is out of the scope of this thesis to analyze separately the impact, direct or indirect, of every each one of these regulations on the European refining industry. The reader is advised to visit

[http://ec.europa.eu/energy/observatory/oil/doc/refining/20140522\\_3nd\\_meeting\\_jrc.pdf](http://ec.europa.eu/energy/observatory/oil/doc/refining/20140522_3nd_meeting_jrc.pdf)

where there is available a progress update concerning the EU Refining sector fitness check. However, there are some important remarks that could be made. Following the insights provided by Meijknecht et al. (2012), there are three important regulations which are noteworthy.

### Fuels Quality Directive

The first is the Fuels Quality Directive (FQD) which mandates a 6% reduction in the greenhouse gas content of petrol, diesel, gasoil and bio-fuels used for transport, between 2010 and 2020. Special attention should be paid to article 7a of this regulation, which refers to the methodology for calculating the greenhouse gas intensity of transport fuels over their lifecycle. It bases the calculation on the feedstocks of origin of transport fuels by applying separate greenhouse gas default values to road fuels produced from three different crude oil qualities, namely “conventional crudes”, “natural bitumen” and “oil shale”, with the last two falling under the category of “unconventional feedstocks” (FuelsEurope, 2013); (Meijknecht, Correljé, & van Holk, 2012, p. 19). In simple words, FQD imposes higher taxation on heavier and sourer crude qualities and thus these become more expensive for refiners, than lighter and sweeter qualities. As it was discussed, these types of heavier and sourer crudes constitute a substantial share of the crude oil slate of many European refineries, which have to pay higher prices for their feedstocks, thus their margins are decreased. The problem is greater for simple European refineries, built to process heavy crude qualities, such as some refineries in Central and Eastern Europe (Meijknecht, Correljé, & van Holk, 2012). Moreover, the higher taxation for heavy crude qualities will probably set significant barriers for imports of certain feedstocks, such as the ones produced from the Canadian oil sands, as these crude qualities will be too expensive for many European refiners. In the end, restricting EU refiners’ access to these types of feedstocks is likely to threaten their competitiveness, vis-à-vis to refineries in other regions where there are no such restrictions (Beddoes & EUROPIA, 2013); (Meijknecht, Correljé, & van Holk, 2012).

### IMO regulations

Another serious issue is related to the changing International Maritime Organization (IMO) regulations, with respect to the quality characteristics of bunker fuels. In the EU level, the relevant directive is the Marine Fuels Directive (MFD), however due to its newness (2012) is difficult to assess its impact on the European refining sector (EC JRC-IPTS, 2014). The regulations of IMO mandate that the allowed sulphur content of marine fuels, within the SO<sub>2</sub> Emission Control Areas (SECAs), is 1% until 31 December 2014 and 0.10% from 1<sup>st</sup> of January 2015. Concerning other EU waters which are outside the SECAs, the limit is 0.50% by 2020 (FuelsEurope, 2014). The SECAs are currently the Baltic Sea and from 2015 and onwards the North Sea and the English Channel will be included (Meijknecht, Correljé, & van Holk, 2012).

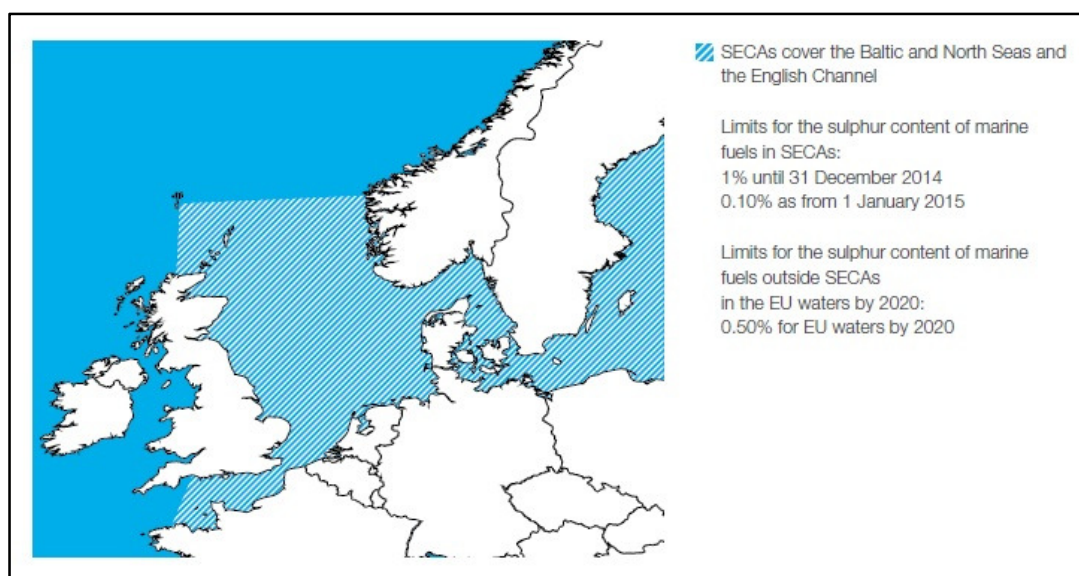


**Figure 32: SO<sub>2</sub> emission control areas (SECAs) and marine fuel sulphur specifications (FuelsEurope, 2014); (Based on data from the European Commission).**

The implication of these regulations on European refineries can be illustrated through the dilemma of having to choose between increasing the share of low-sulphur crudes in their feedstock mix or investing in desulphurization units. In the first case, the refiner would have to pay higher prices for acquiring the necessary feedstock, since sweeter crudes are being traded at a premium compared to heavier and sourer crudes (EC JRC-IPTS, 2014). Furthermore, there are decreasing volumes of light sweet crude worldwide, translated to a lack of available crudes of this type, which otherwise could be processed and produce a lighter product slate and less heavy residue (Meijknecht, Correljé, & van Holk, 2012); (Hureau, Serbutoviez, Silva, & Maisonnier, 2013). To conclude, even if a refinery could manage to access and use these sweeter crude qualities, the refining margins would be eroded due to the high prices required for the acquisition of this feedstock.

In the second case, the refiner would have to invest in an expensive and energy-intensive hydrodesulphurization unit, meaning that apart from the cost of the investment itself, energy costs would increase (EC JRC-IPTS, 2014). Again, higher energy costs would mean higher operational costs and lower profitability. Moreover, the refiner could also consider to simply stop producing marine fuels and to try, instead, to secure alternative markets for the heavy residue produced by the plant. This would also not be an easy task, because there are not sufficient alternative outlets for heavy residues, especially since ships can no longer use these types of fuels (Meijknecht, Correljé, & van Holk, 2012).

Therefore many European refineries (especially coastal refineries (KPMG, 2012)) which did not have the necessary equipment (desulphurization units) to produce fuels meeting the environmental specifications, experienced decreasing refining margins and they were confronted with the need to proceed to investments. Moreover, even if they possessed the equipment, the high energy costs decreased their profitability, especially in comparison to their competitors in other regions outside Europe, who were and are able to provide fuels of the same quality (meeting IMO & EU specifications) but at significantly lower costs.

### The EU energy roadmap 2050

This refers to the EU mandate for further decarbonizing future transport with a 60% reduction of CO<sub>2</sub> emissions in 1990 levels by 2050 (EC, 2011). It is anticipated that this requirement will lead to decreased future demand for oil products and inevitably to the rationalization of the European refining sector. The general decline in demand for oil fuels in Europe has already been discussed extensively, along with the different patterns in demand for gasoline or diesel fuel for transportation. Nevertheless, concerning the future, it still remains to be seen the impact of this EU mandate on the level of demand for fuels and consequently on the European refining sector.

Other important regulations are mainly the EU Emission Trading Scheme Directive, the Industrial Emissions Directive and the Air Quality Directive. In principle, all of these regulations call for a reduction in local emissions (SO<sub>2</sub>, NO<sub>x</sub>, PM, CO, etc.) level, but also in global CO<sub>2</sub> emissions, thus affecting directly or indirectly the costs of many European refineries (Hureau, Serbutoviez, Silva, & Maisonnier, 2013). At the same time, competitors of European refineries are subject to lower environmental restrictions, which makes them more cost-competitive compared to their European counterparts. For example, sulphur limits for diesel and gasoline in Europe are 10-15 ppm and 10 ppm respectively, while in many other regions of the world the limits for the maximum sulphur content in these fuels are significantly higher (see figures below).

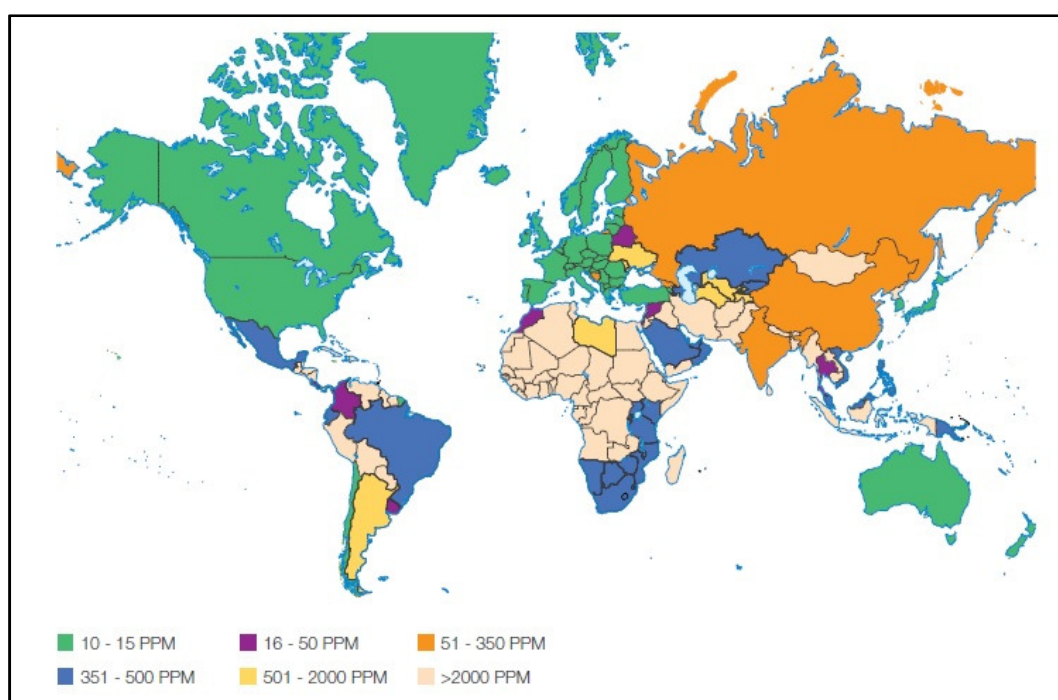


**Figure 33: Maximum on-road diesel sulphur limits (FuelsEurope, 2014); (Based on data from Hart Energy Research and Consulting, January 2014).**

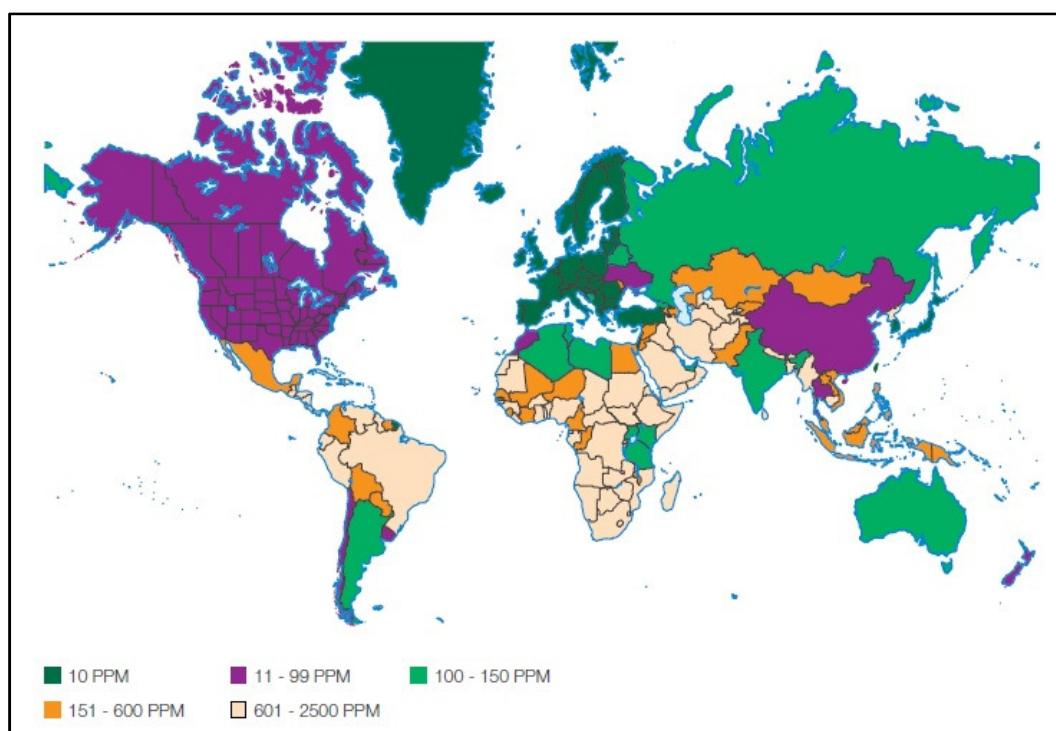


**Figure 34: Maximum gasoline sulphur limit (FuelsEurope, 2014); (Based on data from Hart Energy Research and Consulting, January 2014).**

## Bio-fuels

At this point, a special comment should be made about one more issue which has affected the profitability of the European refining sector; this is related to the Renewable Energy Directive (RED) and the FQD, which are both promoting the use of bio-fuels as substitutes to conventional oil-based fuels. The RED sets a target of 10% share of renewables in the transport sector by 2020, whereas the FQD as it was discussed stipulates a reduction by 6% of the greenhouse gas emissions in the transport sector by 2020 compared to 2010 (FuelsEurope, 2013). The impact of these legislations on the European refining sector, with respect to the goals for further bio-fuels adoption, have been mostly indirect through a reduction in the total demand for petroleum products (EC JRC-IPTS, 2014).

It should be mentioned that there have been some previously-set goals for bio-fuels, such as the requirement for bio-fuels consisting a 2% (based on energy content) of the gasoline and diesel used for transport by 2005 and a 5.75% by 2010, which were eventually not met. For example, for 2010 the bio-fuels consisted a 4.35% of transport fuel consumption on an energy basis achieved. Nevertheless, the effort to meet the targets set by the EC led to an increased conformance to the mandates (Cuthbert, Leavens, Kennaby, & Birch, *Developments in the international downstream oil markets and their drivers: implications for the UK refining sector*, 2011); (Meijknecht, Correljé, & van Holk, 2012). A main reason for not achieving a higher penetration of bio-fuels in the transport fuel mix, has been the lack of arable acreage in Europe for producing first generation bio-fuels, as this lands are necessary for food production as well (Meijknecht, Correljé, & van Holk, 2012). Moreover, taxation-related incentives were chosen as a means to stimulate the production and consumption of more bio-fuels, but these incentives were applied at a national level and they were not comprehensive across the EU. This in turn

led to increased penetration of bio-fuels only in specific member states, which was translated to a failure to meet the EC targets in the EU as a whole (Cuthbert, Leavens, Kennaby, & Birch, Developments in the international downstream oil markets and their drivers: implications for the UK refining sector, 2011). The new mandates included in the RED (2009), are believed to have contributed to a more comprehensive approach towards the goals for the use of bio-fuels, while at the same time these mandates are binding EU member states to meet their obligations and reach the target of 10% of bio-fuels in the transport fuels mix by 2020. Nevertheless, the acreage issues remain for the first generation bio-fuels and next to this, even though second generation bio-fuels are probably more sustainable, they cannot yet be produced economically in significant quantities and there are concerns about lack of relevant feedstocks for their production (FuelsEurope, 2013). All of the discussed considerations show that there is uncertainty about how feasible will be the transition to more bio-fuels used for transport purposes, but at the same time it seems that EC is determined to achieve this transition and hence, bio-fuels are anticipated to play a significant role in the future of transport (FuelsEurope, 2013).

Concerning the impact of bio-fuels on the European refining sector, there are two main effects which can be discussed. The first has already been mentioned and it has to do with the lower demand for conventional fuels, due to bio-fuels blending in the fuel mix. A good example has to do with the demand for oil-based gasoline, which has been decreased both in Europe and North America over the previous years, due to the increased bio-ethanol and bio-gasoline blending in the gasoline pool (Cuthbert, Leavens, Kennaby, & Birch, Developments in the international downstream oil markets and their drivers: implications for the UK refining sector, 2011); (Meijknecht, Correljé, & van Holk, 2012). This development has had severe implications for many gasoline-heavy European refineries which experienced decreasing demand volumes for conventional gasoline and in general a gasoline oversupply in the market, which all together decreased their profits over the past years. The second effect for many European refiners is related to the requirement of blending bio-fuels into the diesel and gasoline pool. This requirement is translated to increased capital investments in storage and blending facilities close to refineries, in order to maintain the bio-fuels before blending, with little return (Cuthbert, Leavens, Kennaby, & Birch, 2011).

It is therefore obvious that many European refiners have experienced thinner refining margins also due to the EU bio-fuel mandates, whereas their competitors regions outside EU are not subject to this legislative burden. To sum up, the cumulative effects of EU environmental regulation on the profitability and competitiveness of the European refining sector are significant. According to EUROPIA (FuelsEurope since June 2014) there is a need in the European refining sector for investments of about \$21 billion from 2008 to 2020, apart from the already \$30 billion announced for the same period, in order to meet the future changes in demand and the regulatory specifications. These \$51 billion are translated to 1\$/b of crude oil processed over the 2008-2020 period, whereas the typical EU refining margins are 1 – 5\$/b (2011 prices) (Beddoes & EUROPIA, 2013). A large share of these investments is required for staying in the business and meeting the environmental specifications, without having any serious return to expect (Elliot, 2013). It is therefore obvious that many European refiners have faced and will keep facing difficult choices concerning their investment strategies, in an environment of tight refining margins, increased competition and demand uncertainty.

## Bibliography

- Beddoes, C., & EUROPIA. (2013). *Key challenges and opportunities ahead for EU refining; Presentation at the EU Refining Forum, November 2013*. EUROPIA.
- Blas, J. (2012, February 1). *Recovering margins to boost oil refiners*. Retrieved from Financial Times: <http://www.ft.com/intl/cms/s/0/e4ce9bfa-4cb3-11e1-8741-00144feabdc0.html>
- Boncourt, M. d. (2013, March). *The European Refining Crisis: what is at stake for Europe, Les Actuelles de l'Ifri*. Paris: Ifri Centre for Energy.
- Bosoni, T., & IEA. (2013). *Recent Developments in EU Refining and in the Supply and Trade of Petroleum Products; Presentation at the EU Refining Forum, 27 November 2013*. OECD/IEA.
- Bosoni, T., & IEA. (2014). *Recent Developments in EU Refining and in the Supply and Trade of Petroleum Products; Presentation at the EU Refining Forum, 22 May 2014*. OECD/IEA.
- BP. (2014). *BP Statistical Review of World Energy 2014*. London: BP Statistical Review of World Energy, BP p.l.c.
- Cooper, S. & Wood Mackenzie. (2013). *Crude Oil in Europe: Production, Trade and Refining Outlook; Presentation at StocExpo-Antwerp, March 2013*. London: Wood Mackenzie.
- Cuthbert, N., Leavens, J., Kennaby, D., & Birch, C. (2011). *Developments in the international downstream oil markets and their drivers: implications for the UK refining sector*. Purvin & Gertz, Inc.
- EC. (2011). *Energy Roadmap 2050: Impact assessment and scenarion analysis*. Brussels: European Commission.
- EC JRC-IPTS. (2014). *Intervention logic for the regulatory fitness check of the refineries sector*. Brussels: European Commission - Joint Research Centre.
- EC/DG-Energy. (2013). *Summary and conclusions of the first meeting of the EU Refining Forum held on the 12th of April 2013. Note for the file*. Brussels: European Commission, Directorate-General for Energy.
- EIA. (2014, April 22). *U.S. petroleum product exports increase in 2013*. Retrieved from US Energy Information Administration: <http://www.eia.gov/todayinenergy/detail.cfm?id=15951>
- Elliot, S. (2013, December 23). *Europe's refining moment*. Retrieved from Platts.com: [https://www.platts.com/IM.Platts.Content%5Caboutplatts%5Cmediacenter%5Cpdf%5Cinsightdec13\\_refining.pdf](https://www.platts.com/IM.Platts.Content%5Caboutplatts%5Cmediacenter%5Cpdf%5Cinsightdec13_refining.pdf)
- Fahim, M. A., Al-Sahhaf, T. A., & Elkilani, A. S. (2010). *Refinery Economics* (1st ed.). Oxford, U.K.: Elsevier.
- Fattouh, B., & Mallinson, R. (2013). *Refining Dynamics in the GCC and Implications for Trade Flows*. Oxford: The Oxford Institute for Energy Studies.
- FuelsEurope. (2013). *Annual Review 2013*. Brussels: FuelsEurope.
- FuelsEurope. (2014). *Statistical Report*. Brussels: FuelsEurope.

- Hureau, G., Serbutoviez, S., Silva, C., & Maisonnier, G. (2013). *Investment in exploration-production and refining 2013*. IFP Énergies nouvelles.
- IEA. (2013a). *Recent Developments in EU Refining and Product Supply; Presentation at the EU Refining Forum, 12 April 2013*. OECD/IEA.
- IEA. (2013b). *Oil: Medium-Term Market Report 2013*. Paris: OECD/IEA.
- KPMG. (2012). *The Future of the European Refining Industry*. KPMG LLP.
- Meijknecht, J., Correljé, A., & van Holk, B. (2012). *A Cinderella Story: Restructuring of the European Refining Sector*. Clingendael International Energy Programme. The Hague: Clingendael International Energy Programme.
- Nelson, R., & CONCAWE. (2013). *EU Refining Competitiveness and impact of planned legislation; Presentation at the EU Refining Forum, 27 November 2013*. CONCAWE.
- Oil and Energy Trends. (2013, August). Europe's refiners face further closures as demand falls and competition grows. *Oil and Energy Trends*, 38(8), 10-18.
- Oil and Energy Trends. (2014, March). European refinery closures continue as foreign competition increases. *Oil and Energy Trends*, 39(3), 3-6.

## Appendix B: Initial items list

This list contains the initial 384 items which were identified from the literature review, during the Q set generation process. The relevant bibliography is presented at the end of this list.

From (Tirone, Carlyle-Vitol Venture to Buy Bayernoil Refinery Stake, 2013)

1. Carlyle Group LP and Vitol Group agreed to buy a 45 percent stake in Germany's Bayernoil refinery from OMV AG (OMV) as they expand oil-processing, distribution and storage operations in northwestern Europe.
2. OMV has looked to sell its Bayernoil stake since hiring Deutsche Bank AG to handle a divestment program in January 2012. The Austrian company is focusing on exploration and production...
3. The Austrian company is focusing on exploration and production as Europe's refining industry struggles to maintain profits amid stagnant demand.
4. For Carlyle and Vitol, they gain access to a 207,000-barrel-a-day plant as well as pipe and storage assets.
5. "The sale decreases OMV's exposure to the downstream segment where there is higher volatility," Oleg Galbur, a Vienna-based analyst at Raiffeisenbank Centrobank AG, said today by phone.
6. "They're betting on a sector that is currently under pressure, that has prices which are low," Galbur said.

From (Bakhsh & Klump, 2010)

7. ConocoPhillips doesn't plan to resume making fuel at the plant because of economic conditions, spokesman Bill Stephens said.
8. The company reiterated that it also may sell the 260,000-barrel-a-day plant or convert it to a fuel terminal.
9. The company is cutting investment in so-called downstream operations after refining profit margins narrowed.
10. "This move is consistent with our stated strategy of maintaining capital discipline and reducing our downstream portfolio over time," Willie Chiang, senior vice president of refining, marketing and transportation, said in the statement.

From (Migliaccio, 2014)

11. Eni SpA (ENI), Italy's biggest oil company, said first-quarter profit fell 14 percent on weak demand in its European businesses and declining refining margins.
12. The refining and marketing division's loss deepened to 159 million euros from a loss of 51 million euros due to excess capacity and competition from Russian, Middle Eastern and U.S. imports.
13. Eni said it sees "continuing weak conditions" and no improvement in demand in the European industries of gas distribution, refining and marketing of fuels and chemical products.
14. The company said it will continue with measures such as cost cuts, renegotiation of long-term gas supply contracts and capacity restructuring to help support its mid and downstream businesses.

From (Rozhnov, 2013)

15. "Purely from the falling European demand point of view, one bigger refinery or two smaller plants would have to shut in Europe every year," David Wech, who helps advise oil companies and governments as managing director at researcher JBC Energy GmbH, said in a phone interview from Vienna.
16. A 50 percent jump in three years in U.S. diesel exports coupled with waning demand for imports of European fuels, as well as two recessions in five years in the euro region, have curbed profit from oil products at companies from Italy's Eni SpA (ENI) to Royal Dutch Shell Plc. (RDSA).
17. The losses are being compounded by the configuration of Europe's refineries. Most of the plants, more than 50 percent of which were constructed in the wake of World War II, are geared toward gasoline production, though diesel now accounts for 75 percent of the region's motor fuel needs.
18. At the same time, newer facilities in the Middle East and Asia are refining cheaper crude grades into high-value fuels.
19. Refiners in Europe are also falling behind because U.S. competitors have access to cheaper crudes and natural gas, while Russian companies benefit from a more favorable export-tax regime, according to Schultz.
20. "Not many companies have money to invest as the refining market has collapsed," said Tomasz Kasowicz, a Warsaw-based analyst at Bank Zachodni Wbk SA.
21. "I don't think current owners of European refineries will make decisions to invest in this circumstance, and they would probably rather exit" if their business can't make profit.
22. Hellenic Petroleum spent 1.4 billion euros upgrading its Elefsina refinery, a multi-year project started before the recession. Without that investment "we would be in trouble now, with only one refinery generating cash for the entire group," Harry Panitsidis, a project director at Hellenic, said in an interview in Amsterdam on March 5. "And it's a big question if people would start today" on a similar project, he said. "You need to be very big and very robust to do that now."
23. "There's no demand, Europe has been flat since 2005," OPEC Secretary-General Abdalla el-Badri said yesterday at a conference in Paris.
24. Italy, where diesel demand dropped in February to the lowest level in almost 10 years, will probably see refinery closures, according to analysts and refiners surveyed by Bloomberg. There are no signs of recovery this year in the country's fuel consumption.
25. Domokos Szollar, head of international communications at MOL, said in an e-mail the company doesn't plan to close any of its refineries and has initiated "a wide efficiency measure project."
26. Total SA (FP)'s Feyzin and La Mede plants, Exxon Mobil Corp. (XOM)'s Fos facility or the Lavera refinery part-owned by Ineos Group Holdings SA are all potentially at risk since they compete in the same market amid low demand for gasoline, Parker said.
27. Total will honor its pledge, made when it decided to shut the Dunkirk plant in 2010, not to close any other refineries until 2015, Victoria Chaniel, a Paris-based spokeswoman, said in an e-mail. "In the European market, our strategy is to adapt capacities to demand evolution and optimize the industrial system by focusing investments to position the best performing sites among the leaders and maximizing synergies," she said.
28. Eastern Europe also has a substantial surplus of refining capacity, with several plants there already operating at low utilization rates, according to JBC Energy's Wech.

29. Ceska Rafinerska AS's Litvinov plant in the Czech Republic is among those at risk of closure, Kasowicz said. "This refinery should change the production mix, and a major shareholder may not do it this year," Kasowicz said.
30. Mikulas Duda, Unipetrol's press department manager in Prague, said in an e-mail that "despite the challenges, we believe that our refineries, including the Litvinov plant, will continue operations in the foreseeable future."
31. Essar Energy's Schultz said he was struck by the differing fortunes of cash-strapped European refiners versus their competitors elsewhere when he attended a conference in New York earlier this year.

From (Bakhsh, 2011)

32. Europe's growing diesel deficit and rising gasoline surplus is leading to increased demand for storage terminals, according to Wood Mackenzie Ltd.
33. Ben Holt, vice president of downstream consulting at Edinburgh-based Wood Mackenzie, said in a Feb. 22 interview in London. "The rising deficit is because of the dieselization of the car pool in Europe, coupled with a switch to gasoil from fuel oil in the bunkering sector in 2015," he said, referring to the switch to cleaner burning fuels in vehicles and ships.
34. Refiners such as Petroplus Holdings AG, Total SA, and Royal Dutch Shell Plc plan to convert plants into storage terminals as falling demand for products such as gasoline and diesel during the worst recession since World War II led to lower profits from processing crude.
35. "We expect oil storage activities in northwest Europe to remain robust in the future as the region's product imbalances are set to widen and contango opportunities are likely to continue in the short to medium term," the researcher said in a note last month.
36. Stanlow "fits very well with our strategy of providing options for the export of high quality products from our Vadinar refinery in India," Naresh Nayyar, Essar Energy's chief executive officer, said in the statement.

From (Kirchfeld, Comfort, & Campbell, 2012)

37. "The trend in Europe is for companies to focus their retail and refinery businesses," said Landesbank Baden- Wuerttemberg analyst Achim Wittmann, who recommends investors hold Exxon shares. "In the upstream sector you have higher returns on investment, coupled with an increase in needed spending as reserves are depleted."

From (Rudnitsky, 2012)

38. The company (Gunvor), which has trading offices in Geneva and Singapore, is seeking to diversify its business from trading Russian crude. It bought two European refineries this year and took a stake in a coking coal project in Russia's Sakha Republic.
39. Gunvor agreed to buy the 105,000 barrel-a-day Antwerp refinery in Belgium in March, part of a plan to help to expand its presence in northwest Europe, the region's oil-trading hub.

From (Rudnitsky & Shiryayevskaya, 2012)

40. "Gunvor appears to increasingly focus on products versus crude trading," Arsenije Dusanic, an analyst at JBC Energy GmbH in Vienna, said by e-mail today.

From (Tirone & Bergman, 2013)

41. "This deal is positive," said Raiffeisenbank analyst Oleg Galbur, who recommends investors hold OMV shares. "It ensures a decent return on OMV's accumulated cash, while clearly following the company's strategy of focusing on upstream and more stable markets," he said of its plans for exploration and production.
42. OMV, which had free cash flow of about 1.6 billion euros (\$2.1 billion) in the first half, said the deal will be largely funded by the sale of downstream assets such as oil processing.

From (Holter, 2014)

43. Shell wishes to concentrate its downstream business where it can "be profitable and grow, which is in other countries than Norway."
44. Shell is preparing to sell about \$15 billion of assets to help meet a net-capital-expenditure goal of \$130 billion from 2012 to 2015.

From (Gismatullin, 2014)

45. In Europe, demand is declining, "but nobody will close refineries," Henry said. Demand is shifting to diesel, where Germany and the Netherlands lead output, making some refineries, built to produce gasoline, less competitive, he said.

From (Patel & Swint, 2012)

46. Total is following BP Plc (BP/) and others in stepping up sales as oil prices hold above \$100 a barrel, creating a stronger market for producing assets.
47. Total executives are cautious when discussing possible sales of factories or refineries in France following a battle with the government and workers to shut its Dunkirk plant. Protests over the plan to shut the refinery threatened nationwide fuel shortages and resulted in the company having to promise the government it wouldn't close another one for five years.
48. To reach the latest target, Total can't sell \$20 billion of assets in the downstream business alone, de Margerie said. Asset sales have become "part of our strategy," he said.
49. The outlook for cash flow gives the company scope to increase dividend payments and invest in production, de Margerie said.

From (Patel, 2010)

50. The goal to sell its Lindsey refinery and U.K. marketing business is part of the restructuring that could also see development of downstream activities in countries where there is growth, de Margerie has said.

From (Patel & Gismatullin, 2013)

51. Total expects a “strong increase in cash flow from upstream startups and downstream restructuring.”
52. In the marketing and services division, Total plans to “adapt its positions in Europe and expand in growing markets particularly in Africa and the Middle East,” it said.
53. “Consumption and demand are declining in Europe,” de la Chevardiére said today at a press conference in London. “We may reduce capacity of some plants.”

From (Patel, 2013)

54. Total SA (FP) will shut a money-losing steam cracker at Carling in France and invest 160 million euros (\$211 million) in making resin and polymers at the site in a bid to boost profitability of petrochemicals production.
55. “The European petrochemicals market is facing continued overcapacity and growing international competition,” said Patrick Pouyanne, Total’s head of refining and chemicals. Hydrocarbon resins and polymers are “promising” markets.
56. Lack of investment and a rapid souring of the market led to a decline of activity at the site, the CFDT union said in a statement today, condemning the job cuts.
57. The explorer wants 2015 downstream profitability to rise by 5 percent compared with 2010 and has promised to reduce European refining and petrochemicals exposure by 20 percent, according to its website.

From (Loder, 2014)

58. The U.S. oil boom has put European refineries out of business and undercut West African crude suppliers.
59. Fifteen European refineries have closed in the past five years, with a 16th due to shut this year, the International Energy Agency said, as the U.S. went from depending on fuel from Europe to being a major exporter to the region.
60. China, already the world’s largest importer, will rely increasingly on crude from the Middle East and refined fuels from the U.S. to meet its consumers’ growing demand.

From (Resnick-Ault & McCracken, 2011)

61. “I can say that we’ve been very explicit about our desire to explore our options in Europe,” said Bill Day, a spokesman for San Antonio-based Valero.
62. Chevron, based in San Ramon, California, is among oil companies selling refineries to cut debt and redeploy spending to oil exploration and development in higher growth regions.
63. Chevron’s view is that “you get better returns upstream than you do downstream,” said Mark Samter, an analyst at CLSA Asia-Pacific Markets in Sydney who covers refiner Caltex Australia Ltd. (CTX), half-owned by Chevron.

64. While margins from turning crude into fuel may improve during the next 12 months to 18 months, countries are adding more refining capacity to increase energy security, “not on an economic rationale,” CLSA Asia-Pacific’s Samter said by phone today.

From (Nguyen & Voss, 2012)

65. Processing margins will stay weak at plants in Europe, deterring potential buyers as major oil companies continue to exit the business, Vitol Chief Executive Officer Ian Taylor said. Along with the closing of unprofitable plants on the U.S. East Coast, consumers will increasingly need to buy fuels such as diesel from further afield, creating trading opportunities.
66. The construction of large, sophisticated refineries in India, China and the Middle East has made some Western plants less competitive at a time when demand has declined in industrialized nations.
67. The company, founded in 1966 has major offices in Geneva and London, is “committed to the trading business for the long term,” Taylor said. “We will be trading oil hopefully for the next 45 years” as integrated oil companies shift their focus to upstream operations and away from trading and refining.
68. “We have to be in it today, tomorrow and the next day, and maybe we’re willing to take a little more credit risk, for example, maybe we’re willing to be a bit more flexible in certain payment structures compared to an international oil company,” Taylor said. “The oil majors continue to selectively exit the downstream and this gives us opportunities.”

From (Smith, 2013)

69. Vitol, based in Geneva, is evaluating a “variety of new investment opportunities in the midstream and downstream energy sectors,” which typically comprise refining, transportation and storage facilities.
70. A Vitol Group venture, Varo Holding SA, last year bought the 68,000 barrel-a-day refinery in Cressier, Switzerland from insolvent Petroplus Holdings AG. The acquisition “underpins Vitol’s expansion into the regional product markets,” according to today’s statement.

From (Chazan, 2014)

71. European refining has been hit by excess capacity and weak demand. Total said European margins averaged \$6.6 per tonne of crude processed in the first quarter, down 75 per cent on year-ago levels.

From (Amiel, 2014)

72. Competition From Abroad and Slack Demand Will Force Refiners to Cut Capacity

From (Werber, 2013)

73. Michel Bénézit, president of Europia, a trade association for Europe’s refiners, presenting a grim outlook for refining in the region, said \$21 billion will need to be spent on investment in the

continent's refineries and that retaining sufficient refining capacity was key to Europe's energy security.

74. The industry is hobbled by having too many plants set up to refine gasoline and not enough to refine diesel, a technical mismatch with demand that is hard to rectify. Meanwhile appetite for refined products overall is waning.
75. What remains of the refining sector will need huge investment to deal with efficiency requirements and concentrate on valuable products, he said. At least \$21 billion will need to be pumped into the industry by 2020, on top of the nearly \$30 billion that has been spent in the last five years. These combined amounts represent about \$1 of capital expenditure for every barrel processed, in an environment where the refining margin—or profitability—is typically about \$1-\$5 a barrel.
76. This week's U.S. oil data from the Energy Information Administration showed that refineries on the U.S. Gulf coast are running at near full tilt, suggesting that refiners there will continue exporting products to Europe. The U.S., which used to import much of the gasoline it consumed, is now meeting many of its domestic needs by refining oil derived from shale. The U.S. oil boom increases the likelihood of a sustained period of high product availability that could crush margins for all refiners in Europe, according to analysts at JBC Energy.
77. The development of refining outside Europe in places like the Middle East and China has also introduced competition. These "unequal environment policies" have lower environmental requirements to Europe, Mr. Bénézit said Thursday.
78. Increasing legislation in Europe and the loss of key markets such as the U.S. are also squeezing the industry, he said, along with the development of more fuel-efficient cars.

From (Rozhnov & Gross, 2012)

79. Refineries in Europe and the U.S. East Coast, once almost exclusively owned by oil companies, are seeing a surge of interest from a new breed of investors that could help provide cash they need to rejuvenate some operations—but at a cost to the sector.
80. Commodity-trading houses, private-equity groups and even an airline are already negotiating or finalizing takeovers of several outdated refineries. And people in the oil industry say a wave of acquisitions and partnerships between Middle Eastern oil companies and cash-strapped refiners in Europe and the U.S. East Coast is also likely. But the change in ownership works two ways. It benefits some struggling refineries in the U.S. and Europe by funneling money into reopening and upgrading facilities, but it could exacerbate the current oversupply of gasoline and lead to more refinery closures in the region, analysts said.
81. Meanwhile in the Middle East, integrated oil companies, which produce crude oil and refine it into high-value products such as gasoline and diesel, have a competitive advantage in the oil-products market. Unlike some of their European peers, Middle Eastern oil companies already have the oil they need for their refineries. Their European counterparts have to pay high market prices for crude and are struggling to make a profit.
82. Although prices have fallen around \$30 a barrel since March as turmoil in the euro zone has pushed economies back into recession and weakened demand, they are still historically high.
83. To make matters worse, an increase in ultramodern and flexible refining capacity in the Middle East has made it harder for the older and less flexible European refineries to stay competitive.
84. Middle Eastern refiners are grabbing more market share in Europe by exporting diesel, now in high demand, to the region. Most European refineries are geared up to produce gasoline, which isn't so sought after in Europe.

85. "The Middle East is where the money is right now, and given the high oil prices, it's sensible for them to divest into the refining and petrochemical industry," said James Zhang, an oil analyst at Standard Bank.
86. Middle Eastern companies see an opportunity in acquiring stakes in European and U.S. refiners for what are now discounted prices, industry executives and analysts said.
87. "Producers with lower costs are invading Europe and especially the Mediterranean," Domenico Elefante, executive vice president for refining at Italy's Eni SpA, said in a recent interview. "The question is how to face the invasion."

From (Business Monitor News and Views, 2013)

88. The conversion of the refinery into a products logistics hub will enable the company to move away from the low-margin refining sector and improve its competitive position in Italy through the higher-value storage and logistics sector.
89. The conversion of the refinery will most likely be cost effective for the company, as most of the necessary infrastructure is already in place. The logistics network, the storage units at Porto Marghera and the 120km pipeline connecting the port and the Mantova refinery previously used to transport crude from the port to the refinery will be used to transport end-products to the refinery for storage.
90. Similarly to the Mantova refinery, Eni is in the process of converting its Venice facility into a bio-refinery in a move to transform the low-profit refinery into an economically sustainable industrial operation over the long term.
91. Changes in product demand and growing international competition from new, large and efficient refining centres in several Asian and Middle Eastern countries (India and Saudi Arabia for example) have forced the reorganization or the closure of several refineries. 15 refineries have closed since 2008 in Europe, with companies relocating investments to Asia and the Middle East.
92. In Italy specifically, refineries are typically of lower complexity and provide few economies of scale. As a result, they are particularly vulnerable to cyclical downturn in markets for refined products. Weak demand in Western European product markets has severely reduced refining margins in the country; for example, the margin from refining Libya's Es Sider crude had been negative for most of 2009 and parts of 2010. As a result, this has forced Italian players to seek the reorganization of its domestic refineries.
93. To improve Gela's efficiency and profits, Eni plans to convert the refinery into a 'technological hub' by 2017, with a new industrial and organization structure capable of varying its product slate by maximizing production of diesel and interrupted production of gasoline and polyethylene.

From (IEA, 2011)

94. OECD Europe has also seen opportunistic purchasing of distressed refining assets by producers keen to get an operational toe-hold in a maturing, but nonetheless strategically placed, swing refining hub.
95. Robust new-build capacity in China, the Middle East, other Asia and Latin America, much of it highly complex and aimed strategically to add value to rising domestic crude oil production, will likely place older and less complex capacity in the OECD under increasing pressure.
96. Oil product supply balances point to increased tightness in middle distillates towards 2016, as demand growth is heavily skewed towards diesel, gasoil and kerosene. Gasoline markets will

remain under pressure, as North America achieves self-sufficiency for the motor fuel and surpluses in Europe, the FSU and Asia remain.

97. As a result capacity, European refinery utilization has been very weak since the downturn of the global economy.
98. The European refining industry is continuing to see major changes due to structurally declining demand, intense export competition from new capacity in emerging countries and resulting poor margins.
99. In addition to the plants already closed or scheduled to close, several refineries are currently officially for sale. Some of these could face shutdown if no buyer is found, although prohibitive site remediation costs encourage operators to continue operating sites for storage rather than shutting them down completely.
100. Several refineries have changed ownership in the last year, and it is particularly noteworthy that largely upstream, cash-rich non-OECD companies are making an entry into the EU refining, buying plants at distressed prices.
101. On 10 January, China's state owned PetroChina and UK-based Ineos signed an agreement to form an oil refining and trading joint venture, marking China's first move into the European refining sector. The deal encompasses Ineos' two European refineries: the Grangemouth refinery in Scotland and the Lavera refinery in Southern France, both with processing capacity of around 210 kb/d. The cooperation includes the sharing of refining and petrochemicals technology and expertise between the respective businesses.
102. The deal marks Shell's exit of the UK refining market and allows Essar to enter the European downstream market. Essar might use Stanlow's distribution network to place clean products from its Indian west coast Vadinar refinery.
103. While the influx of capital from cash-rich overseas interests sustains local employment and allows for the potential upgrading of mature European capacity, it does little to address a continent-wide problem of surplus refining capacity.

From (IEA, 2008)

104. Indeed, as long as consumption in the Big Five continues to contract overall demand growth in Europe will continue to decline. The weakness in the largest countries is due to a variety of factors: lower economic growth; population decline (notably in Italy and Germany); the ongoing "dieselisation" of Europe's vehicle fleet; and the gradual interfuel substitution of fuel oil and heating oil in favour of natural gas and renewable energy sources.
105. Specifically, the emergence of excess supply potential in the gasoline market, particularly in the Atlantic Basin has, in combination with heavily negative fuel oil cracks, weakened refinery margins. This reduces the operating cash flow necessary to fund investments by refiners and the potential rate of return achievable.
106. In the longer term, one possible solution is for European refineries to replace catalytic cracking capacity with new hydrocracking capacity. However, this would require significant investment, which appears unlikely given the prospect of CO<sub>2</sub> emissions taxation in the future.
107. In addition to the increasing regional supply shortfall, discussions with refiners cite three key reasons for the move to boost refinery complexity. Firstly, the increasingly tight product specifications for transportation fuels that are due to come into force in Europe will necessitate significant investment even to maintain the status quo of Spanish refineries' competitive position.

108. Secondly, the prospect of tighter fuel oil specifications being introduced, both for inland and international marine bunkers, over the next five to 10 years will require additional hydrotreating investment which offers little opportunity for a satisfactory return on investment, at today's market prices.
109. Thirdly, the opportunity to switch the crude slate to a heavier, sourer intake, offer the prospect of increased margin potential. Consequently, refineries have opted, in one form or another, to reduce the exposure to, or exit, the fuel oil market and at the same time convert the fuel oil into light products with a bias toward middle distillates.

From (IEA, 2009)

110. Refineries, particularly in Europe and the US, face ongoing investment requirements from tighter product specifications and environmental regulations. This will continue to absorb a significant proportion of planned capital expenditure for little financial benefit, at a time when cash flow is under pressure from the weaker margin environment.
111. The projected reduction in utilization rates is likely to force refineries that lack scale, have a high exposure to product trade, or are uncompetitive in term of costs, to temporarily shutdown and potentially face permanent closure. However, given high exit costs, e.g., site remediation, such capacity is likely to face temporary rather than permanent closure.
112. However, much of the growth projected in recent years is driven by strategic rather than purely economic reasons. Consequently, one would expect many of these projects to be relatively unaffected by the economic downturn. In reality, a surprising number of these strategic projects have fallen victim to the deterioration in future returns in recent months. Several strategic reasons for refinery investment have been cited. Firstly, resource holders who seek to capture an additional share of the value added chain by becoming vertically integrated with downstream operations.
113. Refinery yields are a function of refinery complexity and crude input. Thus, a surge in demand for middle distillates, or any other refined products can only be met by changing configuration of refinery or the type of feedstock or some combination of both. Making changes to refinery configuration or upgrading refining capacity entails capital investment with long lead times, while change of feedstock is an operational, short term decision.

From (IEA, 2012)

114. OECD Europe, confronted with diminishing demand, challenging environmental standards, constraints in feedstock access and a refining fleet that includes many aging assets, faces continued capacity attrition.
115. Despite the increase in refining capacity, middle distillate markets remain tight throughout the forecast period. Product balances point to continued middle distillate tightness towards 2017, as diesel, gasoil and kerosene lead demand growth.
116. Gasoline markets will remain under pressure, as North America achieves self-sufficiency while surpluses remain in Europe, the FSU and Asia.
117. A structural shift in demand, from gasoline to diesel, is continuing to cause refiners problems as they have to find outlets for surplus gasoline production, often at discounted prices.
118. Regionally, Europe has the largest deficit in middle distillate supplies, and the region's net-imports for diesel, heating oil and jet kerosene averaged just under 1.0 mb/d in 2011. The lion's share of the imports came from the FSU, but increasing volumes were also sourced from North

America, the Middle East and Asia, while smaller shipments to Africa provided some offset. Looking towards 2017, Europe's distillate deficit will most likely rise, with our base case scenario pointing to net imports attaining levels closer to 1.4 mb/d at the tail-end of the period.

119. The decline of North American gasoline imports is a challenge for European refiners, which traditionally have provided around 70% of regional imports.
120. While investments in technology and equipment have increased diesel yields at European plants, this shift has mostly taken place at the expense of fuel oil: while the average annual gasoil yield at European refineries increased to 39.2% in 2011 from 34.4% in 2000, gasoline yields only decreased from 22.6% to 20.8% in the same period.
121. In 2011, OECD Europe exported some 800 kb/d of gasoline. In addition to North American markets, Africa and the Middle East also provided outlets. As the North American import market is set to shrink further towards 2017, while European surpluses will continue to increase unless further refinery closures occur, Europe will likely struggle to find new markets.
122. Nevertheless, in the medium-term, the region's oil product demand is set to continue to decline, by 840 kb/d in total from 2011 to 2017, albeit at slower rates than seen over 2011 and 2012. All products fall, though the largest declines stem from light products (naphtha and motor gasoline) and fuel oil.
123. While Europe's gasoline surplus looks set to shrink only modestly over the medium-term, to remain around 800 kb/d, gasoil import requirements will increase further. The region's net imports for diesel, heating oil and jet kerosene averaged almost 1 mb/d in 2011 (including non-OECD Europe). The lion's share of imports came from the FSU, but increasing volumes were also sourced from North America, the Middle East and Asia, while smaller shipments to Africa provided some offset. Looking towards 2017, Europe's distillate deficit could attain levels of up to 1.4 mb/d in 2017.
124. Russian refinery upgrading projects are continuing apace, although some concerns about delays have recently arisen. Russia embarked on a multibillion dollar refinery modernization programme, enabling the country to move towards higher fuel qualities over coming years.

From (Guarerra, 2008)

125. While environmental restrictions are hindering new additions and upgrades in many parts of the Mediterranean, a shift in demand towards tighter product specification, mainly for transport, is pushing demand upwards and increasing the needs for upgrading units. The conversion units that are needed are costly and take a long time to build.
126. From project phase to realization, capacity additions take a minimum of 5–10 years to become operational because of the time constraints and environmental restrictions.
127. Furthermore, most refinery upgrades are concentrated in meeting crude oil quality challenges and in increasing oil product quality specifications to meet new European Union (EU) regulations, not only in EU countries but also in most Mediterranean countries.
128. For the refining industry, increase in sulphur and in density of crude oil trends have a significant impact on processing requirements, both desulphurisation capacity to produce high quality gasoline and diesel, as well as the conversion requirements to minimise fuel oil production, while meeting gasoline and diesel fuel demand requirements.
129. Unless other markets (such as China or India) are found, the Mediterranean will have substantial surpluses of gasoline and no market at horizon 2015. The picture is even grimmer

when taking into account the European Commission's biofuel targets. Coupled with the latest EU transport measures, this would lead to an even greater surplus of gasoline at horizon 2015.

130. The increasing dependence of EU and Mediterranean countries on Russian diesel will reinforce the geopolitical tensions, especially for European countries already heavily reliant on Russian gas.

From (Fattouh & Mallinson, 2013)

131. Investment in refining was (and is) still considered by many policy makers and analysts as a key step towards achieving broader diversification and job creation. This is not simply because refining creates added value by converting crude oil into refined products, but also because refining establishes the link between the upstream sector and petrochemicals, which in turn provides opportunities for diversification and downstream integration into the full value chain, including the development of new industries.
132. The combination of GCC reduced gasoline imports, together with increased GCC exports of diesel and kerosene, is likely to put pressure on global refining margins, particularly for diesel and on European refining margins where competition from other product exporters such as the USA, Russia and China is set to intensify.
133. For NOCs in the (GCC) region, stiffer competition in exports markets represents a challenge, but also an opportunity to establish and develop their trading arms and to play a bigger role in the global petroleum products markets by opening new markets, enhancing their expertise and skills in the trading of petroleum products and creating trading hubs.
134. But all major export refining hubs with a diesel bias are earmarking Europe as their top destination, especially as Europe, Latin America, and parts of Africa are the only regions in the world that will be left with a growing appetite for diesel imports.
135. Although the exact timing of the reduction in fuel oil production remains unclear, as it will depend on when Russian refinery projects are completed, Russia is firmly committed to raising diesel exports to Europe in the coming years.
136. Both Asia and the GCC will be relying on growing gasoline imports from Europe, which may provide some limited relief for European refineries that have been faced with substantial declines in exports to their main customer, the USA, and increasingly struggle with competition in Latin American and African markets, as US refineries continue to capture market share for gasoline as refinery utilization has been at record levels over the past three years.
137. These changes in trade flows of oil products and stiffer competition represent a challenge for GCC refineries, but they also represent an opportunity for the region to step up its game in the area of oil products trading by creating trading hubs, establishing committed trading arms and enhancing its expertise in the marketing of petroleum products – more challenging than trading crude oil, given the different specifications of the products and evolving regulations in international markets.

From (Oil and Energy Trends, 2012a)

138. One of the principal factors driving the closure of refineries is the surplus of gasoline across the European Union (EU), which has depressed refinery margins for some years.
139. By shutting down distillation units, Europe's refiners are reducing the production of straight-run gasoil, exacerbating an existing shortage of diesel fuel, resulting in a rise in the import of diesel from

140. Amongst the first to sell their refineries were international oil majors British Petroleum (BP), Shell, and Total.
141. The three sales have gone to companies that specialize in trading rather than refining. Traders claim to be better at supply logistics than many refiners.
142. Some (traders) may eventually close down their refinery units and operate the sites as storage terminals.
143. Others may try to ride out any further downturn in the refining business in the hope of profiting from a future revival in demand, when there would also be less competition as a result of refinery closures elsewhere in Europe. The problem with this is that several new Middle Eastern refineries scheduled to come on-stream over the next few years are designed to export refined products to markets in Europe.
144. The nearest European market to the Arabian Peninsula is the Mediterranean. Refineries here are particularly vulnerable to closure owing to the small size and lack of upgrading capacity of many of them.
145. Further refinery closures are expected to be announced in the Mediterranean before the end of 2012. One Italian refinery, however, the 320,000 bpd Isab refinery at Priolo in Sicily, is planning to buck the trend of closures and capacity cuts by investing in new upgrading units. The refinery is a joint venture between ERG and Russia's Lukoil. It is one of a small number of merchant refineries that has no large captive market nearby and exists by selling to a wide range of buyers across Europe and beyond.
146. Another source of overseas competition for Europe's refiners is the US.
147. Europe has therefore had a growing surplus of gasoline over the last decade with few overseas outlets capable of absorbing it.
148. The closure of the UK's 220,000 bpd Coryton refinery, assuming no buyer can be found, would remove a large producer of gasoline from the market and would even turn the UK into a net importer of motor spirit over the long term; but there would almost certainly be plenty of gasoline available from elsewhere in the EU, even if other refinery closures go ahead more or less as planned.
149. Further EU refinery closures risk exacerbating another problem, namely the EU's shortage of diesel fuel.
150. The growth of diesel consumption in the EU has been fostered by favorable tax treatment in some cases—notably France—but more generally by the popularity of four-wheel drive vehicles and large so-called 'people carriers'. Diesel saloon cars have also become increasingly popular, as the price of petrol has risen because of their greater fuel efficiency. This has been the case even in markets such as the UK where diesel is significantly more expensive than petrol.
151. Europe's refiners have responded to the rise in diesel demand by building more hydrocrackers and adding hydrodesulphurization units to produce diesel to lower EU sulphur limits.
152. Most new hydrocracking units are planned for the Mediterranean, where refineries are less fully upgraded than in northern Europe.
153. Diesel's share of the transport fuels market, however, may be about to reach a plateau, or even decline. Sales of petrol-driven cars have recently begun to revive, and this could be part of a long term trend if proposals by the EU for higher taxes on the carbon content of fuels are adopted, since these look likely to penalize diesel at the expense of gasoline. Unfortunately for refiners, any shift from diesel to gasoline is likely to happen too slowly to remove Europe's gasoline surplus for several years.

From (Oil and Energy Trends, 2011a)

154. A survey of world refining by Oil and Energy Trends has concluded that refining in Europe faces an uncertain future due to a combination of static or even declining demand, poor margins, and increasing competition from refineries in other regions.
155. As if these problems were not enough, refiners are being obliged to spend increasing sums of money on upgrading and other technologies to comply with new EU standards on fuel quality and regulations designed to reduce carbon emissions.
156. Furthermore, EU policies designed to reduce dependence on fossil fuels could further reduce demand for refined products in general.
157. Until recently, large volumes of gasoline could be exported to the US—the world's largest gasoline market—but US demand for imports of European gasoline has been hit by the greater use of ethanol in the US gasoline pool and by competition from other foreign refiners to supply the US.
158. All this is forcing many refiners in the EU to reconfigure their refineries to produce more diesel and less gasoline. The answer is normally to increase hydrocracking capacity, but this represents a high cost at a time when refining margins in the EU are under downward pressure and likely to remain so, perhaps for many years.
159. Europe's refiners produce too much high sulfur atmospheric residue and not enough kerosene. Demand for kerosene has risen sharply in recent years with the growth in air traffic; but as well as going to jet fuel, kerosene is also increasingly required in the diesel pool to meet new EU standards on sulfur in diesel fuel.
160. Further refinery upgrading, including more hydrocracking, would alleviate the kerosene and atmospheric residue problems, but rather than investing in upgrading, oil companies may prefer to balance their production by means of imports.
161. Moreover, the use of the trading option rather than the hydrocracking option does little to solve the problem of the EU's gasoline surplus.
162. This last (refinery) sale was to an Indian refiner, Essar, and reflects a move on the part of some Asian companies to turn themselves into international, integrated oil companies.
163. Refinery closures there have led to a number of strikes, such as that last October over the proposed closure of Total's 140,000 bpd Dunkirk refinery.

From (Oil and Energy Trends, 2013)

164. Europe's refiners are also seeing a marked fall in their traditional export markets. These export markets include the US, Africa, and Latin America, where European refiners are losing market share to new refineries in the Middle East and Asia and to a recently revived US refining industry, and where planned refinery developments in both Africa and Latin America threaten further erosion of Europe's export sales.
165. Much of the current competing capacity is in large, new and efficient refineries in the Middle East and Asia, many of which are specifically designed as export refineries.
166. Refining in Europe is also becoming more costly and less economic as a result of environmental legislation that adds both to their capital and operating costs;
167. Under legislation currently under discussion, EU refiners could have their access to some cheaper crudes, including shale oil, severely restricted.
168. Europe also has a number of old, small refineries that produce too many low value products and feedstocks.

169. Over the same period, US refinery production of gasoline is likely to increase, boosted by rising domestic production of light, sweet crude and a fall in the cost of refinery fuel from cheap domestically produced natural gas.
170. Moreover, US refineries will be in a position to supply other European export markets such as Latin America and Africa. On the basis of the competitive advantage they derive from lower crude and fuel costs, US refiners should be able to go on eroding European refiners' market shares in these markets.
171. Thus, although the EU will have to lose more distillation capacity, it will need to add hydrocracking capacity to meet the expected rise in diesel demand if it is not to rely increasingly on imports.
172. Upgrades are also taking place in Russia where new hydrodesulphurization capacity will enable refiners there to export more ultra-low sulfur diesel to the latest EU specifications.
173. The growth in diesel fuel consumption over the last decade or so has come about largely through a switch by EU motorists from petrol to diesel-powered motor cars. Diesel engines were preferred for their better fuel economy in an era of rising fuel prices, but high retail prices for diesel have dented diesel's advantage.
174. The cost of fuelling and taxing large diesel-powered four-wheel-drive vehicles and people-carriers continues to rise. Furthermore, the taxation of diesel fuel could be about to change as a result of proposed EU legislation to impose taxes on the carbon content of fuels, which would hit diesel harder than petrol.
175. Europe's present gasoline surplus is blamed by many for the parlous state of much of the EU's refining industry, but a revival in gasoline demand is unlikely to do much to rescue the refinery sector. Any gasoline revival is likely to be slight given the state of the economy across the EU, which reduces not only the level of driving but also the rate at which new gasoline vehicles are purchased.
176. In countries like France, Spain, and Italy, many refineries ended up in the hands of state-owned national oil companies. Refineries in these countries were often seen as instruments of national economic development and it became politically difficult to rationalize them into fewer, larger units. The result was that these countries found themselves with excess capacity and too many small and inefficient plants.
177. At the same time, the international oil majors have begun to dispose of refinery assets as they move their operations increasingly upstream where they are able to earn higher margins.
178. The exit of IOCs from the European downstream market has left the way open for a new breed of refining firms that operate more like traders than as utility-style companies that supply regular volumes of products to local and regional markets, as was the pattern in Central and Eastern Europe and across the Mediterranean. These new merchant refiners seek to maximize returns across a range of markets by looking for mainly short-term supply opportunities in volatile markets. Many of the new merchant refineries are owned by companies that came from a background of commodity trading.
179. The business model of the new merchant refiners is based on keeping costs low and operating on tight margins. Their expertise is based primarily on their ability to track prices closely across many markets and then move quickly to take advantage of low crude prices or high product prices. In many ways, it is the efficiency of their logistics that governs the profitability or otherwise of their operations rather than any expertise they might have in refining.
180. Such companies can thrive in volatile markets. They have an advantage over many traditional refiners by not being burdened with the huge capital costs involved in refining. Traders are often able to pick up refinery assets at discounted price following the bankruptcy of their previous owners.

181. Eventually, new capital investment will be required even in these new-style merchant refineries. There are also rising costs associated with complying with environmental legislation emanating from the EU.
182. The main issue for the European refining industry as a whole is that by buying and operating merchant plants the commodity traders are prolonging the oversupply of distillation capacity that many refiners see as the European industry's most serious problem.
183. Trading companies are not the only new owners to have entered Europe's refining industry in recent years. A number of refineries have been purchased by foreign oil companies, most notably Russia, India and China. Some Russian oil companies' purchases of European refineries appear to be linked to a desire to secure downstream outlets for their companies' crude oil production. Crude oil producers are not necessarily interested in refinery units. Some may want access to sites that can be used as storage and break-of-bulk points for crude oil cargoes. The future for a number of European refinery sites may be as terminals rather than as refineries.
184. The level of foreign investment in EU refineries has raised concerns in Brussels, where some officials have expressed fears that this could cause problems for EU energy security in future. Most of the concern appears to center on the involvement of companies from Russia, which are seen by some in the EU as having too great a share of the EU's energy business.
185. Some of the new owners of Europe's refineries may eventually close the processing units and keep the sites as terminals. These would probably be used in a number of cases to import refined products, which might increase fears in Brussels over the EU's energy security.
186. France's socialist government came under pressure from trade unions to nationalize the plant in order to save jobs but failed to take any action.
187. Essar says that margins are improving thanks to cost-cutting and the company is investing in additional gasoline production capacity.
188. ERG has also been reducing its stake in the 320,000 bpd ISAB refinery at Priolo in Sicily in a move that has seen it reduce its refining capacity by about 60% as it shifts focus more towards its power generation and renewable energy businesses.
189. Last year, Lukoil announced a further upgrade of the ISAB refinery. Upgrading is also taking place at the 300,000 bpd Sarroch refinery with the aim of increasing the production of diesel.
190. In June 2013, Phillips 66 announced that it was seeking buyers for Ireland's only refinery: the 71,000 bpd Whitegate unit in County Cork. The company believes that the refinery is too small and unsophisticated to compete effectively in Europe. The lack of upgrading capacity means that it has to run mainly on more expensive light, sweet crudes compared with other, more sophisticated refineries.
191. Eastern Europe has a number of small and inefficient refineries dating from the era when the region was part of the Soviet-led Council for Mutual Economic Assistance (Comecon). These refineries, many of which are situated far inland, ran on subsidized crude oil supplied as part of the Comecon system of trade with satellites of the Soviet Union. Following the break-up of both the USSR and Comecon, these refineries have had to pay international prices for their crude. Most of these countries are now members of the EU.
192. The Czech Republic's refineries are majority-owned by Unipetrol, which has indicated that it wants to reduce its exposure to the refining industry.
193. There is probably not enough business to allow all these refineries (in Central-Eastern Europe) to operate profitably over the longer term.
194. The central problem for Europe's refiners is that demand is declining while competition to supply the European market is growing. The result of this is that the present surplus of crude

distillation capacity across the EU is set to grow. More refinery closures will follow, especially of the smaller and less sophisticated plants.

195. EU refiners face further threats in the form of higher taxes on emissions and other environmental measures. They are also under pressure from Brussels and national governments to curb future increases in the prices at which they sell their output.
196. Some companies are moving to a merchant refining business model where they concentrate on keeping their cost-base low and cut their margins in order to compete effectively in a wide range of markets; but this business model might work equally well without a refinery, using imported products and restricting the hardware used to a terminal.
197. Other firms intend to move up-market by adding upgrading, mainly in the form of hydrocracking and hydro-desulfurization; but this is no guarantee of survival in a shrinking market and financing the upgrades is likely to prove difficult.

From (Oil and Energy Trends, 2014)

198. A new source of competition has recently begun to emerge in the shape of Russia, which has started a process of reconfiguring its large refinery sector to enable it to compete successfully both in markets across the EU and in those outside Europe that are normally supplied by refineries in the EU.
199. The refineries most at risk appear to be those in landlocked locations and those with the lowest upgrading capacity necessary to meet the EU's increasingly stringent rules on fuel quality.
200. Last year, ENI announced a \$900mn plan to upgrade its loss-making Gela refinery in southern Italy to improve operational efficiency and to enable it to maximize production of the most profitable products, such as diesel.
201. The closure of refineries has become a major political issue across the EU with strikes and other actions called to protest against proposed closures.
202. France's largest refiner, Total, has been at the receiving-end of several protests. It has now promised not to shut any more plants before 2015, but it may eventually have to close more capacity. The likely candidates are the company's least upgraded plants.
203. Another such refinery is Ireland's 71,000 bpd Whitegate plant, which was put up for sale by its owner, Phillips 66. In this case, the government stepped in to declare that the closure of the country's only refinery would adversely affect Ireland's energy security.
204. There are also vulnerable refineries outside the EU. Switzerland's small and landlocked refining sector looks particularly likely to see one or more closures. Norway has more distillation capacity than it requires to meet domestic demand and any deficit could be easily supplied by nearby countries.
205. The decline in fuel oil consumption is a particular problem for the least sophisticated refineries as they produce large volumes of it and are unable to upgrade it into lighter, more valuable products such as diesel or jet fuel because of their lack of upgrading capacity.
206. West Africa has long been a market dominated by European refiners. The region has few refineries of its own and many of those operate at low levels of output. Nigeria is the largest market with four refineries but these only operate at about one third of their nameplate capacity. From almost no gasoline exports at the start of 2008, US refiners now account for up to one fifth of West Africa's approximately 300,000 bpd gasoline market. They are also supplying increasing volumes of diesel and kerosene.

207. French officials are privately worried that the recent opening of a 400,000 bpd joint-venture refinery by Total and Saudi Aramco at Jubail in Saudi Arabia could make it easier for the company to close refinery capacity in the France and supply its wholesale and retail networks with product from the Middle East.
208. The government responded by announcing that it would increase the export tax on fuel oil to encourage investment in upgrading units. The move was intended to encourage the production of products in general, including diesel, and also promote improvements in the quality of gasoline and other fuels. In 2011, Moscow announced that it was considering further changes to export tariffs to discourage the production of fuel oil and heavy residues such as straight-run atmospheric residue and vacuum gasoil. The result has been a rise in the production of high quality fuels to international standards such as Euro 4 and 5, which makes them more attractive in export markets. Russia could therefore provide small but growing competition for EU refineries in areas such as the Mediterranean.
209. Although aimed at Asian markets, Russia's plans could ultimately affect refiners in Europe too, as the trade in long-haul refined products continues to grow. In what might be an indicator of European refining trends, Rosneft has indicated that it is no longer interested in increasing its presence in Western Europe. The company has refining assets in Germany and Sardinia, but has recently announced that it is "not . . . looking into further expansion" in refining in the EU.

From (Oil and Energy Trends, 2010)

210. High oil prices and low economic growth have helped to produce a long, slow decline in consumption in the industrialized countries that make up the OECD. Oil use fell by 8.4% between 2005 and 2009—from 49.5 mn bpd to 45.3 mn bpd—and may well be in permanent decline. All this constitutes a major problem for the main international oil companies, since nearly all their downstream assets are located in the OECD. One option for them is to try and shift their focus away from the OECD and towards areas such as India, China, Brazil and the Middle East, where demand continues to grow. These markets, though, are dominated by national oil companies and, in some cases—like India—a few locally-based private oil firms. Entry to these markets, however, is restricted in order to protect the market share of domestic oil companies: all of which leaves companies based in the OECD jostling for position in a declining market. The only solution to this second problem is to reduce downstream capacity: and nowhere is this more important than in the refinery sector. OECD refiners have belatedly begun to close uneconomic refining capacity.
211. There is scope for many more refinery closures, but some governments are trying to slow down the process, fearing that the result will be a rise in imports of refined products, which they see as representing a threat to national energy security.
212. Capacity closures are controversial in a number of areas where there is little or no economic growth and high unemployment.
213. Total's refinery plans have created a political storm in France. Trade unions and politicians have accused the company of abandoning its French home in favour of other countries, such as Saudi Arabia...

From (Oil and Energy Trends, 2011b)

- 214. What is alarming many refiners—especially those in the Atlantic Basin—is that the growth of capacity worldwide is outstripping the growth in demand by a considerable margin.
- 215. Refineries in the EU have suffered a double loss in recent years. Not only has their domestic market shrunk but they have also lost much of their export trade in refined products to the US.
- 216. Throughputs have continued to fall during the recent years as high crude prices and relatively low product prices continue to dent margins. The aim of the closures is to raise the utilization of refinery capacity to a more economic level.

From (Oil and Energy Trends, 2012b)

- 217. US refiners are beginning to think less about closures and more about reconfiguring their operations to run on cheaper crude and to export more of their output. There are even proposals for new refining units. Europe's refiners, by contrast, faced with low margins and the prospect of increased costs from environmental legislation, continue to talk of retrenchment and further closures.
- 218. Europe's downstream companies increasingly see their future as being in activities other than refining. ERG's decision to shut the Rome refinery is part of a longer term strategy to shift the emphasis away from refining to more profitable areas such as power generation and renewable energy.
- 219. Another European refining company that is changing its focus is Petrom, the Romanian subsidiary of Austria's OMV, which is to concentrate more on the upstream side of its business.
- 220. Refiners meanwhile complain that EU directives on carbon emissions, air quality, and other environmental issues are imposing heavy costs on their industry, driving some of them out of business.

From (Oil and Energy Trends, 2013b)

- 221. As well as shutting crude distillation capacity, French refiners need to reconfigure their refineries to produce more diesel.
- 222. Oil industry groups are also calling on the (French) government to reduce the differential between the prices of gasoline and diesel at the pump in order to boost the consumption of motor spirit.
- 223. There may yet be help for French refiners who switch to higher diesel production thanks to proposed changes in EU import tariffs on diesel. Import duties for several countries, including Russia, are due to be raised by 3.5% from January 1, 2014.

From (Oil and Energy Trends, 2012c)

- 224. In the US and EU, falling utilization rates reflect both a decline in demand and a general failure by the refining industry to adjust crude distillation downwards to reflect the full impact of the decline.
- 225. To a long-term decline in oil consumption in the EU, has been added the crisis affecting the euro, which threatens to spill-over into a full scale banking crisis, of which the principal effect on the refining industry is a shortage of credit as debt-stricken European banks try to strengthen their

capital bases. The inability to obtain credit appears to have been a significant factor in the problems affecting Swiss company, Petroplus.

226. Many of the refineries that have closed (in Europe), once belonged to vertically integrated oil companies with large captive retailing and wholesaling networks. Returns on these networks have fallen as demand has declined and several integrated companies have begun to sell part-or even all-of their downstream networks in various countries.
227. Some of the most successful refiners now are merchant refiners without large captive markets, such as Italian refiners Saras and Erg Petroli and Finland's Neste Oil.
228. One of the factors prompting the conversion of European refineries into storage terminals is the growing need for facilities to handle the increasing volumes of products being exported by refineries in the Persian Gulf and Asia.

From (Fielden, 2013)

229. Meantime, across the pond, things are not looking so pretty for European refiners. For one thing unlike their US counterparts, there is no supply of cheap tight oil crude from shale for them to tap into. The majority of European refiners import crude from Russia, Africa and the Middle East and pay prices linked to the international benchmark North Sea Brent crude that has been more expensive than US domestic crude for the past two years.
230. European refinery fuel costs are higher than those in the US because off-gasses and intermediate products produced from crude oil are typically used as refinery fuel instead of natural gas. (And natural gas is much more expensive in that market anyway.) As much as 7% of each barrel of crude processed is consumed that way.
231. Many of the shuttered refineries were older less efficient plants that could not survive reduced product runs and lower refining margins.
232. That European gasoline surplus was traditionally exported to the US East Coast during the summer to supplement supplies during the driving season. Historically East Coast gasoline supplies could not be met from local refineries or pipelines from the Gulf Coast and were supplemented with imports from Europe. As we have described however, US demand for refined gasoline has fallen in recent years due to the addition of 10% ethanol and increased vehicle efficiency.
233. With higher refining costs and prices than their US counterparts, European refiners cannot compete effectively in the expanding export market for gasoline that US refiners are exploiting in Latin America. And the US crude oil refining slate is now producing increased volumes of gasoline components from lighter shale crude output. Since US domestic demand for gasoline (like Europe's) is declining, that means more gasoline will be headed into the export market to compete with European outputs.
234. Aside from the US, European refiners are also facing competition from closer to home in the form of increased refinery exports from Russia as we mentioned earlier. Russia has traditionally sold crude or residual fuel oil to Europe but they have now invested in refinery upgrades to produce more valuable refined products for export.

From (Young & Mumby, 2013)

235. In the refining segment, Q2 2013 has also proved that being one of the super majors does not mean you are impervious to market pressures and the toughening up of environmental legislation.

From (Carlyle Group and Vito Group, 2013)

236. Global alternative asset manager The Carlyle Group and the Vitol Group are establishing Varo Energy BV as a midstream energy business in northwest Europe.

From (Cole, 2011)

237. Many in the investment banking ranks have embraced a saying familiar among oil traders: There's only one true hedge in a tight market, and that's to hold physical supplies. Recognizing the uptrend in oil markets since the 1990s, those bankers have expanded their role beyond trading paper barrels to holding physical assets, refineries, pipelines, and tankage. That gives them the true hedge – the capability to take delivery of physical oil when futures contracts expire and hold scarce wet barrels.

From (Dison, 2011)

238. (Opportunity for oil and gas companies if they get involved in trading); Knowledge of the full value chain: By investing in a trading strategy, oil and gas companies will be given the opportunity to see the full value chain. Most companies know how to pull oil out of the ground, refine it and sell it. But tremendous value exists in understanding the entire marketplace to gain critical knowledge that can be exploited to know what levers to pull and when. For example, what move do oil and gas companies need to make if a ship goes down carrying 1 million barrels of crude? Having insight into the full value chain makes for smarter upstream and downstream bets, and will influence upstream and downstream capital investments.

From (Oil & Gas Financial Journal, 2009)

239. The more relaxed emission criteria have provided an impetus for operators to move their refinery operations from Europe and North America to Asia-Pacific.

From (Oil & Gas Financial Journal, 2012)

240. Refinery location has become a major factor for operators as it relates to crude sourcing logistics, expansion possibilities, environmental pressures and competition, noted Pross. The US East Coast refining industry has been under particular pressure as it faced higher crude oil input costs compared with Mid-Continent counterparts. Refineries located in more densely populated areas tend to face greater environmental scrutiny, and many of these refineries are older, less complex and less flexible to handle a wide variety of crudes from multiple sources.
241. Several European refineries sold in 2011, after remaining on the market for several months, including ConocoPhillips' Wilhelmshaven refinery in Germany, which was sold to Dutch firm Hestya, and Chevron's Pembroke refinery in the U.K., which was sold to Valero, giving Valero its first site in Europe, allowing it to optimize its Atlantic Basin strategy. This was also an opportunity for Asian firms to gain a foothold in Europe at favorable prices, and Shell's Stanlow refinery in the U.K. was sold to Indian firm Essar Energy, while PetroChina acquired interests in the Grangemouth refinery in Scotland and the Lavera refinery in France.

- 242. Several European refineries have been shut-in and converted to terminals as these refineries have become less economic, struggling with a margin squeeze from overcapacity, falling demand and higher feedstock cost, particularly due to fewer sourcing options with the loss of Libyan crude, which was a severe blow to margins for Atlantic basin refineries.
- 243. Asian countries such as China and India, face growing demand for fuels, which could drive Asian companies to look at additional assets elsewhere, including the US and Europe, as potential acquisition targets that could competitively serve those regions.
- 244. Refiners that have chemical operations will have an advantage because a broader slate of product offerings can cushion against market-demand swings for fuel products (...).

From (Oil & Gas Financial Journal, 2010)

- 245. European refiners will be faced with significant changes in the availability of traditional crude supplies – The outlook for declining North Sea production and Urals availability will require reliance on other forms of imports. BTC and CPC Blends will see large increases in available export volumes, but the overall quality of these barrels are not a fit for the current regional refining configuration and product demand needs. A shift in crude oil trade balances for the region will be required to offset these issues of quality differences and available supplies.

From (Ascher, Laszlo, & Quiviger, 2012)

- 246. Traders should develop mid-to longer-term company strategies that include substantial investments in differentiating downstream and upstream assets in core and new geographies.
- 247. Trading houses are now reevaluating their overall company strategies. Given the extent of change and the magnitude of capital needs, they will have to adapt their longer-term perspectives. It is not usually natural for commodity traders to think and strategize in horizons longer than ten years – often the typical lifetime of a successful trading strategy is not much more than 18 months. A clear strategic roadmap and a robust balance sheet will go a long way to secure physical assets or to build significant positions in the financial area as banks retreat or recapitalize. In the physical arena, traders might acquire assets ... in Europe (distressed downstream assets at attractive prices).
- 248. To protect their margins, traders increasingly seek to own and operate physical assets that they arrange into complex end-to-end supply chains. Such supply chains provide access to unique profit pools, for example, sourcing and blending streams to meet local requirements across the Atlantic basin or to provide turnkey services such as fuel supply and conversion into power for smaller nations.
- 249. Physical assets and end-to-end supply chains also open opportunities to gain access to exclusive and unpublished market information. Hence, while price-reporting agencies are relentlessly increasing price transparency, the informational values of physical-asset ownership is increasing.
- 250. Three large waves of regulatory change in the banking and derivatives –trading environments will further drive up financing and transaction costs while also creating new business opportunities for physical players as banks scale down their own commodity-trading activities.
- 251. ...regulations will raise transaction costs across the board. Continued presence in many physical segments will require much lower cost structures.
- 252. Global leaders will optimize geographical footprints in order to minimize cost structures, especially with regard to support functions and tax arbitrage.

253. Continued access to competitively priced and flexible capital will become a major differentiator (for traders). Trading groups backed by large integrated groups will probably find it less difficult to expand their balance sheets. Independent traders will find it harder.

From (Cuthbert, Leavens, Kennaby, & Birch, 2011)

254. Ultimately, exporters may have to look further afield to markets such as Latin America or the Middle East, or UK gasoline production will need to decline, implying some rationalisation of gasoline production capability. This would need to be achieved by re-configuring existing refineries rather than closing current capacity as that would result in a further increase in middle distillate imports as production would be lost through closure.
255. From the point of view of security of supply, refineries located in the UK provide for greater security of supply. This is because the refineries process crude oil that can be sourced from many different countries and regions whereas refined product imports are sourced from relatively few locations.
256. Given that the lead time for construction of new refinery plant is around five years, in the short to medium term there is a risk that middle distillate supply would be needed from less economically effective plant, such as hydroskimming refineries. Under such a scenario, higher prices for middle distillates relative to other oil products are likely. This would be a global issue, impacting the global economy, but would be most keenly felt in Europe (and therefore the UK) where middle distillate imports are most required to meet total product demand.
257. Until recently, the refineries and most of the marketing was under the control of international oil companies (IOCs). However, over recent years the international companies have increasingly focused on the upstream, where they perceive they have a competitive advantage through technical capability and financial muscle, and which provides the potential for greater financial returns. But, as exploration and production has become more expensive and oil companies have been seeking to increase their capital reserves, IOCs have been shedding less profitable but capital-intensive activities, such as the downstream, where they hold little competitive advantage.
258. If the (UK) domestic refining industry is to reconfigure its plants and change its yields from being gasoline-predominant to diesel-predominant, then significant investment will be required. IOCs and larger NOCs are usually able to make such investments from their own cash reserves, but less well funded owners will have to raise capital from the financial markets. As a result, they will incur a higher cost of borrowing, which may render them being unable to finance large projects economically. In the case of Conglomerates, competition for capital will not only be the same issue that the IOCs currently have, but will extend to other businesses within the company portfolio.
259. Another issue related to the sale of refineries is the disintegration of the supply chain resulting from the separation of refining from the associated marketing business. A presence in retail and commercial markets gives refiners some advantage as a secure outlet exists for product and the transfer-sale price of the product will be beneficial to both refiners (who would otherwise have to sell product at a lower, export-based price) and marketers. In fact, this trend will tend to reinforce itself, as the loss of a marketing arm also results inevitably in some inland sales being lost, such that additional quantities of products will have to be sold through the refinery gate, thus putting increased downward pressure on refinery-gate prices. Effectively, this results in the refinery moving from being part of an integrated supply chain to being a merchant refiner exposed to the lowest market price. Whilst this situation is superficially attractive in periods of abundant supply as consumer prices may be reduced, loss of the refining capacity has the potential be a real

problem if or when the supply situation changes, with the consequence that consumer prices will increase disproportionately as additional, marginal supplies are sought.

260. Although overall crude runs in Europe are expected to decline gradually in the long term, some countries with higher-than-average demand growth are likely to add distillation capacity along with conversion projects. Offsetting this, we expect capacity will probably be closed in other locations, where economics become unfavourable; such changes are consistent with the long-term rationalisation of the refining industry, which results in the concentration of capacity into larger, more efficient refining sites.
261. The decline in gasoline demand is likely to have a significant impact on several European refiners, resulting in the rationalization of some gasoline-making facilities, especially in inland markets with few export opportunities.
262. Although there were some refinery investments in Europe in the first part of last decade to increase diesel yields through residue destruction, most of the increase in diesel demand was met through increasing imports. At times of relatively poor refinery margins, the preferred strategy of most refiners was to invest in hydrotreating and other desulphurisation processes and import high-sulphur gasoil streams for upgrading into diesel.
263. The refinery investments (and divestments) in North Europe are certainly for product supply into the North and Central European markets.
264. The refinery investments in Central Europe can be regarded as servicing the local market.
265. The refinery investments in can be regarded as servicing the local market (Southern Europe).
266. One key message is that Europe (and indeed the UK) should not be overly concerned about the development of middle distillate export refineries in other regions, as the production from them is required to balance expected European demand. However as large new refineries are commissioned there will be a boost to product supply and downward pressure on refinery profitability as is being seen now. As the capacity is absorbed by market growth in the export location a better balance is achieved and profitability restored.
267. It is also interesting to note that the majority of European refineries either recently closed or currently announced as closing are of a lower capacity and less complexity.
268. The requirement for the majority of EU refiners to have to purchase some CO<sub>2</sub> emissions credits therefore would put them at a disadvantage to refiners situated outside the EU, particularly those that are close by such as in North Africa, Ukraine or Belorussia. In the longer term this could further discourage operation and investment in EU refineries leading to an increased reliance on sourcing products from other regions.
269. Most of the higher petroleum demand countries in Europe have been unwinding their biofuel excise duty exemptions and replacing them with biofuel mandates and obligations. The low uptake of biofuels began to concern the EU and there was a move to set a firmer requirement for biofuel to contribute 10% of fuel by 2020, rather than the non-binding targets of 2003/30/EC.
270. The bio-fuel mandates have impacted refiners in two ways. Most notably, the increase in blending of bio-ethanol and other bio-gasoline components into the gasoline pool has reduced the demand for conventional (refinery) gasoline in North America and Europe. This has increased the potential for oversupply of gasoline particularly in the European markets, increasing the economic pressure refineries that were primarily designed to produce gasoline. By contrast bio-diesel production and blending has partly helped to ease the tight supply situation for diesel, particularly in Europe.
271. The requirement to blend bio-fuels into diesel and gasoline has meant that additional tankage and blending facilities had to be provided at refineries and terminals to store the biofuels before blending. Therefore some capital investment was required to meet the mandate with little

investment return. The impact of bio-component blending on refinery margin is different for every refiner, depending on which properties constrain the refinery gasoline and diesel pools, and the changing prices of the biofuel component compared to conventional refined fuels.

272. The compulsory stock obligation represents a cost to players in the UK downstream industry. The costs are absorbed by the different suppliers and in theory this is recovered in the price of the product sold via the retail or wholesale businesses. Such an arrangement is not transparent, as the CSO costs for different suppliers are not the same and the recovery of CSO costs may or may not be specifically applied in product pricing.
273. There are other compulsory stock obligation mechanisms that exist, for example having a central national stock holding agency responsible for holding strategic stock. These agencies can be government owned or public companies. Such agencies are often financed by a specific CSO tariff or levy placed on the sale of hydrocarbon products. The agency ensures that sufficient stock is held in country (or under bi-lateral agreements) to meet the obligation, and operates independently from the day-to-day product supply market. Nevertheless there is often significant co-operation between the agency and suppliers, and often sharing of transportation and storage facilities. Such a system has the advantage that it ring-fences the cost of holding CSO stock away from the commercial supply chain, and usually ensures that the majority of stock is held in-country.
274. Previous work undertaken for DECC concluded that the profitability of UK refiners in terms of net cash margin relative to their European competitors was poor. It should be noted that this analysis over 2005 to 2008 covered a period when the British pound was strong against both the Euro and the US dollar, which would increase the operating costs for UK refiners compared to their European or US counterparts. In 2009 and 2010 the pound was significantly weaker against both the Euro and US dollar, directionally reducing operating costs for UK refiners compared to their European or US counterparts.
275. One key point to note is that complex refineries located in India or US Gulf Coast and the Middle East may have higher gross or net refinery margins than many UK refineries, yet these refineries are much less competitive when it comes to supply of product into the UK market. This is a result of the high freight cost of moving product over long distance from the US Gulf coast or India to the UK.
276. It should also be noted that the average price of middle distillates or light products in the UK (and European) market is in most cases significantly higher than the cost of producing these products. This reflects the fact that for middle distillates the UK and European prices must be high enough to attract product from as far afield as Asia to meet the demand. The UK and European price therefore has to cover both manufacturing cost in Asia and the long distance freight cost to the European market.
277. With the separation of crude oil supply from refining and the growth of independent refineries came the next development; a growing market for traded products. This in turn allowed marketing companies without any crude oil production or refining interests to emerge, purchasing their products from local refiners and export based refiners elsewhere. These developments have resulted in the current fragmented state of the industry with each of the crude oil production, refining and distribution and marketing segments operating largely independently of each other. There are now widespread and liquid markets for crude oil, refined products and refinery feedstock.
278. In general the upstream market has been more profitable than the downstream market, owing to commodity markets focusing on crude oil and some control of crude oil prices exercised by OPEC, holding back production from the lowest cost producing fields under the OPEC quota system. This has allowed development of much higher cost crude oil resources (such as deep-water fields and oil sands) but has also squeezed profitability in the downstream business.

279. In the rest of Europe many governments retain a level of ownership or influence in their “national” oil companies. Most of these companies, like BP, are seeking to expand outside of their national borders and many have acquired assets in diverse geographies. For example Eni has acquired refining assets in the Czech Republic, Germany and Portugal. The Hungarian company MOL has acquired refineries and retail assets in Italy, Slovakia and Croatia.
280. International Oil Companies : The higher profit potential and associated large investment costs in the upstream segment have become the strategic focus of most of the IOCs. In order to maintain their oil reserves they have to spend increasing sums on exploration and development of new oil resources and capital is being redirected away from other activities, particularly the downstream. The lower returns on investment achieved in the downstream have caused most IOCs to reduce their downstream exposure, particularly in the mature, low growth markets. This is particularly true in Europe where declining gasoline demand and a wide range of increasingly complex regulation erodes profitability. As a result, IOCs are selling downstream assets in a move to reduce their overall exposure to the segment and to upgrade the profitability of their remaining asset portfolio. In some cases they are refocusing on growth markets to maintain a downstream presence, in other cases some are looking to dispose of refining assets while maintaining their retail marketing presence.
281. National Oil Companies: In general the NOCs continue to maintain a high priority towards their local markets. In many cases the national government can exercise a high degree of control even when its shareholding is reduced to a minority level. They usually have either a monopoly or majority interest in refining and marketing in their home country and a high share of the retail and commercial fuels market. National supply security is generally a high priority. National supply security is generally a high priority. In some cases the “National” status results in commercial pressure to retain uneconomic or poorly performing assets in their home markets.
282. Other NOCs that are active in the downstream outside of their home markets include the Russian and Asian companies. The strategy behind Russian companies securing downstream assets is typically to secure outlets for crude oil. The priority has been to acquire assets on the export pipeline systems or those refineries that process a high proportion of Russian crude. A secondary consideration is to diversify their income away from their home country. However there is growing political pressure to increase investment inside their home countries in the same way that the Middle East NOCs have changed strategy. Chinese companies PetroChina and CNPC have also been active in acquisition of downstream assets although the motivation for this is not yet clear, other than a reported strategy of building a broad business platform in Europe and becoming leading international energy companies.
283. Independent refiners: The Independent refiners in Europe split into two categories, those legacy companies that entered the business back in the 1960s and 1970s and the more recent entrants which have acquired existing assets sold by the majors/IOCs and NOCs. The former have tended to migrate to niche markets, although some such as ERG and Saras have developed very large refineries. They have been long term investors and many have invested heavily to develop their companies, building world class facilities. Their focus tends to be on cash generation rather than return on assets. The new Independents have been able to acquire assets cheaply and operate them with a low overhead and low cost business model. Their funding sources are a combination of venture capital and equity; this limits access to funds, and as a result investment capital is tight. The Independents can be unwilling to make substantial, non-return mandatory investments and may either sell or close a site where this is required. In many respects this mirrors the decisions that an IOC would take when faced with the same situation. However the Independents do not have the alternative of investing in higher return upstream projects. One of the imperatives for an

independent is to build a portfolio of assets. A company with a diversified portfolio of operating assets is more attractive to investors as operating risk is diluted. A portfolio of assets also allows corporate overheads to be spread, reducing unit costs. The independents typically have experienced industry managers who are commercially focused. They are responsible and experienced operators and invest in developing their assets. Generally their interest is long term and as their focus is on the refining and possibly marketing sector they tend to be well managed.

284. Conglomerates: They have typically developed in an emerging market and have enjoyed a degree of government support. They can take a longer term view of business and be prepared to make substantial investments to develop their companies in the longer term. However, there can be issues regarding their ability to adapt to business practices in new countries of operation and “cultural” issues can arise. In particular there may be an expectation of a level of government support similar to that enjoyed in their home country, which may not be forthcoming elsewhere.
285. Financial Investors: Financial investors typically, but not always will have a short term time horizon for asset ownership, expecting to resell at a profit within a five year time frame. Any acquisition is likely to be highly leveraged and therefore vulnerable to a sustained period of poor profitability. Although highly astute business people financial investors are unlikely to have in-depth knowledge of the refining industry and will rely on the employees of the business they acquire to continue operations. Generally they would not embark on a major investment project as they do not have the management skills to control it. Also the typical time to develop and implement a major refinery project is around four years, which is approaching their limit of tenure, and therefore does not provide enough time to pay back the substantial investment required. However financial investors will consider capital investments that they consider will add value to the business particularly if this value can be captured when the assets are sold.

From (Accenture, 2012)

286. Downstream and midstream energy asset disposal has played an important role in energy companies’ recent strategies to achieve healthy leverage ratios.
287. Restructuring or diversification may also create a need for partnership of energy assets portfolio in order to acquire new operational competencies, to source and trade new commodities, access new markets and/or meet regulatory obligations...Refining operators may need the new skills and capabilities partners can provide when, for example, shifting from catalytic hydro-treating to catalytic hydro-cracking refineries or when investing in alternative fuel transformation (bio-gasoline, bio-diesel gas to liquids). Shell’s partnership with Cosan to form Raizen is one example of a new joint venture between conventional and ethanol fuel producers to achieve synergistic benefits within cross-commodities energy markets.
288. For example, a trader is expected to partner with a power plant operator to manage feedstock sourcing and products marketing, taking full exposure on upstream and downstream market and credit risks. The plant operator, on the other hand, takes on the construction and operational risks arising from plant development and operations, in isolation of market fluctuations.

From (Cooper, S. & Wood Mackenzie, 2013)

289. Beyond 2018, further decline in North Sea production has a noticeable impact on the European crude slate... It is expected that all other things being equal, there would be increased crude import

requirements between 2018 and 2025 and therefore increased requirements for crude storage in Europe from 2018 onwards.

290. Low forecast refinery utilization and possible future closures to negatively impact on storage rates, particularly if refinery closures continue to result in conversion to storage terminals.

From (Beddoes & EUROPIA, 2010)

291. EU refining sites will on average pay for 30% of their CO<sub>2</sub> emissions, resulting in an average 13% rise in operating costs and reduced competitiveness vs. non-EU sites

From (Kemp, 2013)

292. The most straightforward way to shift the fuel mix would involve adding a hydrocracking unit. Unlike an FCCU, which cracks heavy gas oil from the atmospheric distillation column, a hydrocracker cracks much heavier residuals like vacuum gas oil under tremendous pressure in the presence of hydrogen and produces mostly diesel and jet.
293. However, the capital cost is very high. Six inch-thick specialty steels are required to contain the intense pressure - 100- 200 times atmospheric pressure - required for hydrocracking to take place efficiently. Hydrocrackers require a source of extra hydrogen, which is expensive. In most cases, a steam methane reforming unit must be built to produce hydrogen from natural gas. The hydrocracker will also require a sulphur recovery unit. Hydrogen reacts with any sulphur in the feedstock to produce deadly hydrogen sulphide gas which must be burned or converted to elemental sulphur to be sold. Most refineries, struggling with low levels of profitability and relatively weak balance sheets, simply cannot afford the cost of installing major new processing units.
294. To change the gasoline/diesel output mix "you need hydrocracking technology and this is probably around 1 billion pounds per refinery", the UK Petroleum Industry Association, which represents refiners, told the Energy and Climate Change Committee. "Economically that is not really justified."
295. There is fierce disagreement about why refiners are not investing more. Refiners blame the high cost of complying with new fuel standards, safety requirements and other legislative changes being imposed by the European Union and national governments, which they claim is diverting investment away from other more productive areas.
296. It was poor profitability that encouraged the international oil companies to sell their European refineries to smaller independents, which has exacerbated the problem because the small independents have less balance-sheet capacity to finance multi-billion dollar capital expenditure projects.

From (Ernst & Young, 2014)

297. Storage facilities that deliver global connectivity and trading potential continue to attract acquirers, with conversion of refining facilities also being considered, particularly in markets with stagnant or declining oil demand (such as in the US or Europe) and surplus, relatively inefficient refining capacity.
298. Capital discipline — 2013 has seen the IOC's, in particular, come under increasing pressure from their equity investors to deliver better returns on capital and to return cash to their

shareholders. With the cost of the mega projects in which the IOC's specialize under severe upward pressure this will continue to drive portfolio optimization as they focus their portfolios more ruthlessly than ever before on the areas where they can demonstrate competitive advantage. For some this may mean aggressive divestment campaigns; for others, more innovative financial structuring solutions.

299. Storage terminals are a crucial part of the downstream supply and trading industry. In recent years, demand for capacity has climbed, especially in the United States and Europe, due to:

- Increasing geographic imbalances between refining production and consumption
- Increasing products with different Specifications to comply with regulations, leading to a greater need of segregated storage and blending capabilities
- Increasing activity from independent retailers/distributors and hypermarkets
- The impact of oil trading, contango storage and compliance with compulsory stock obligations

Given the strategic nature of storage assets, competition is intense between oil and gas companies, independent storage operators, oil traders and infrastructure funds ... The intense competition for storage terminals in the United States and Europe is expected to continue. The alternative would be to acquire refineries that have been or could be converted into storage terminals.

From (KPMG, 2012)

300. Many European refineries built 30 to 40 years ago using less sophisticated technology are now at a disadvantage. Built to a smaller scale to process lighter, sweeter crude oils, producing an excess of gasoline, and with strong labor laws and high wages; many European refiners have experienced an erosion of their margins.
301. With the transfer of some European refinery ownership to non-European companies, their new owners are less likely to be influenced by local politics when considering maintaining unprofitable plants.
302. European refiners are increasingly focusing on investing in tighter portfolios of quality "survivor sites" to maintain both quality and competitive advantage.
303. ...where a refinery retains inherent advantages from its location and existing plant, then reinvesting in existing or new plant can prove profitable.
304. Closing a refinery is a complex and costly procedure. Environmental costs, demolition work and other costs can be very high. The environmental costs of cleaning up the site will be a major expense. Substantial regulation requires removal of the accumulated pollution resulting from decades of past use where requirements were often less demanding than those today. Employment law, including pensions and severance benefits, is another key issue to be managed, with the costs of severing employee contracts often unexpectedly high. In addition, problems may also arise from the conflicting interests of multiple stakeholders, including the refiner, local government, regulators and employees, which ultimately can lead to protracted disputes and significant legal costs.
305. Converting refineries to terminals can mitigate many closure costs, extend the asset's useful life, reduce the plants costs and release working capital. If well located, and if the tank farm and logistics assets are in good condition, this can be an attractive alternative to closing the refinery

completely. But not all refineries are suitable for conversion to terminals; key constraining factors include the on-storage capacity, the transportation links and the access to surplus capacity.

306. Companies from outside the region can seek out European acquisitions with the purpose of converting the site to storage for use as a trading hub. Depending on the market position, opportunities may exist to make more money trading oil through the site than processing – and buying an established site simplifies compliance for environmental regulations.
307. For Essar, however, the acquisition of the refinery was justified on a number of levels. Naresh Nayyar, chief executive of Essar Energy, believes that the current oversupply in the market will end as smaller refineries close. With the acquisition, Essar can now ship crude oil refined from its Vadinar refinery in Gujarat to the Stanlow refinery, using the Tranmere Oil Terminal on the River Mersey. Finally, Stanlow can help Essar deal with cheaper, heavier crudes, which would increase margins for finished products. Commenting on the deal, Nayyar says, “It is a good price. It would cost US\$5 billion to build from scratch. It gives us access to an important market”.

From (Ernst & Young, 2013a)

308. Various groups of buyers, especially those from Asia and FSU with equity crude and oil traders, are likely to be interested in the relative complex refining assets. On the other hand, interest for relatively simple refineries would depend on whether they could be converted into storage facilities.
309. Besides securing energy resources, Asian oil and gas companies, including NOCs, have been strategically expanding their downstream presence in developed economies to derive synergies with their growing global upstream production. Additionally, the downstream expansion helps them strengthen their international oil trading position with the addition of refining capacity, product storage, pipelines and other logistical assets.

From (Hureau, Serbutoviez, Silva, & Maisonnier, 2013)

310. Mention should also be made of Italy, particularly the ENI group which has not taken the same view as other companies in Europe and has instead decided to invest €700 million in the Gela refinery (which has been running at a loss) in order to overcome the site's structural weaknesses, transforming it into a technological hub. The idea was to keep pace with market requirements more effectively, optimising diesel production with the option to discontinue production of petrol. According to ENI, a competitive advantage is possible through innovation and research. The project is proactive and courageous because it will depend heavily on increases in margin. It would seem that ENI is relying on margin recovering in the medium term as refining capacity falls across Europe and consumption either recovers or stabilises, helping the economy to eventually recover.
311. Regulations that are being introduced, especially in Europe, call for a reduction in current local emissions levels (SO<sub>2</sub>, NO<sub>x</sub>, PM, CO, etc.), as well as global emissions levels (CO<sub>2</sub> for the most part, via quota allocation plans and the Emissions Trading Scheme directive in refineries. As a result, more emissions reduction techniques will need to be deployed, which will act as a drag on investments.

From (Elliot, 2013)

- 312. The refining sector is also impacted by EU legislation on renewables, emissions trading, strategic oil stocks, marine fuels, energy efficiency, energy taxation and chemicals.
- 313. Europe's refining sector has been beset by a combination of challenges including alternate fuels; collapsing demand; rising engine efficiencies; fierce overseas competition; sluggish investment; the extensive burden of health and safety worker conditions; and, more recently, emissions legislation.
- 314. It's unlikely traders want refineries to make money as a stand-alone operation. Gunvor, on its website, says: "Refineries complement Gunvor's trading function, which can create greater operational efficiency across the supply chain. Gunvor is leveraging its expertise and excellent relationships with crude suppliers to gain access to the types of crude oils processed at its refineries."
- 315. Vitol emphasizes its "global access to crude and feedstock" which can provide attractive crude input options. "The products produced can be made available to our product trading teams. Vitol continues to look for opportunities to work with crude oil producers to access our owned refinery system and with other refiners to optimize their investment by accessing the best possible crude oil and feedstock alternatives."

From (Oil & Gas Journal Editors, 2014)

- 316. A number of integrated oil companies intend to reduce their European footprints, but political sensitivities in Europe can also stall or prevent widespread capacity curtailments.

From (Ernst & Young, 2013b)

- 317. Rosneft has signed a cooperation agreement with Saras SpA (Saras) to set up a 50-50 JV for trading and crude processing, as well as selling oil products. The JV will allow both companies to capitalize on their upstream and downstream position by utilizing Rosneft's access to crude oil and other feedstock supplies and Saras' downstream presence in the Mediterranean market. Saras operates the 300,000 barrel a day (b/d) Sarroch refinery, which accounts for 15% of the total refining capacity in Sardinia. Additionally, the two companies will seek to enter and develop new oil product markets and activities to complement the existing marketing channels of Saras.
- 318. OMV plans to divest its 45% stake in the Bayernoil refinery in Germany as part of its plans to offload \$1.3b in assets from its downstream business by 2014. The other shareholders of Bayernoil refinery are Ruhr Oel GmbH, Eni and BP with 25%, 20% and 10% stake, respectively. The decision aligns with OMV's announcement, made in January 2012, to focus its refining business on refineries with integrated petrochemical and upstream operations.

From (Ernst & Young, 2012b)

- 319. Internalization drivers for Market seekers: Access to markets, Access to technology, Integration to capture value along the supply chain, Investment of profits from domestic oil and gas production, Diversification of activities to reduce exposure to commodity price volatility, Domestic/foreign listings and IPOs.

From (EurActiv.com, Reuters, 2014)

320. Russia's strategy of buying up oil refineries in Europe could compromise the bloc's energy security, EU officials said in a draft report prepared for the region's leaders ... In a report prepared ahead of a summit meeting of EU leaders in June, the European Commission is expected next week to make public its vision of how to improve energy security in response to the crisis in Ukraine, the transit route for roughly half the gas Russia exports to the European Union. Among the many issues it says need to be closely monitored, it cites increased Russian ownership of EU refineries. "Combined with the dependence on Russian crude oil, and the emerging influence of Russian players, the refinery industry is vulnerable to political interference," a draft seen by Reuters of the Commission's strategy on EU energy security says.
321. There is no immediate threat to oil supplies, as Russia lacks sufficient capacity to refine the oil it produces and relies therefore on EU refineries, the Commission says. But Director General for Energy in the Commission Dominique Rostri said the Commission was assessing "all aspects" of energy security, including refining. "Our main concern will be to increase the preparedness for the next winter" he said on the sidelines of a conference on the EU refining industry. The Commission is expected to call on member states to assess their vulnerability to any supply crisis and to build up inventories.
322. Some countries are particularly vulnerable, namely the less integrated and connected regions such as the Baltic and Eastern Europe. Lithuania, Latvia, Estonia, Finland, Slovakia and Bulgaria depend on Russia as single supplier.

From (Sykes, 2013)

323. The Middle East and Asia-Pacific are becoming prominent refining centres with a substantial number of new refinery projects and refinery expansions scheduled to come on stream in the next few years ... The expansion of the refining sector in these two regions can be explained by a combination of interlinked factors, ranging from high growth in fuel consumption, easy access to capital markets and easy access to crude supply.
324. While highly complex refineries cost more to build and marginally more to run, high complexity enables the newly built refineries in Middle East and Asia-Pacific to process heavier, cheaper crudes and achieve considerably lower costs per barrel of product and at the same time produce a higher yield of greater value products, further enhancing their competitive advantage.
325. India will continue to be a net exporter of oil products. Private companies such as Reliance and Essar will continue to prioritise exports over selling into the domestic markets, since these exports are more profitable, due to the system of oil product subsidies imposed within the Indian domestic markets.
326. In Europe the most determinant factors contributing towards refinery survival will be scale, location and level of complexity. European refiners enjoying a competitive advantage based on these factors will be significantly better placed to continue operating in spite of the current weak margin environment. Small and low complexity and low conversion refineries will be at risk of closure as they are unable to compete with their much larger competitors and will be unlikely to be able to justify costly upgrading investments.
327. The NOC's in many countries of the Middle East and in China are responsible for approximately 90 per cent of all refining investment, but these NOC's are also frequently seeking partnerships with International oil companies to strengthen their competitive position in refining markets and at the same time share in the risks associated with building such world scale facilities.
328. The major oil companies always appear to anticipate the downward trends and have been exiting the European refining sector for many years. Since 2003, Total has slashed its refining

capacity on the European continent by 24 per cent, while Royal Shell and BP have reduced their by 40 per cent. These companies are now turning their attention to the Middle East and Asia in search of more lucrative deals in the downstream sector of the industry, taking advantage of the industry boom in the two regions.

329. A similar strategy is being carried out by Saudi Arabian and Indian refiners but this time in reverse, by aiming to win market share in the West. Indian refiner Essar has bought Stanlow refinery in the UK, with the aim of obtaining a foothold in the UK market and at the same time gained access to additional financial funding by becoming quoted in the London stock exchange.
330. As export markets are estimated to continue to be more profitable for Eastern refiners than home domestic markets, Eastern refiners will be unlikely to want to switch to selling into their own domestic market, unless there are significant changes in the system of domestic fuel subsidies within their own countries.
331. In a separate article published by the journal, Pedro Miras, chairman of Spain's emergency oil stockholding agency, Cores, and chair of the International Energy Agency's standing committee on oil emergency questions, says the closures "could affect security of supply, not today, but in the long term."
332. But Soeting (KPMG) also points out that the European downstream sector might have some hope. Petrochemical demand is expected to continue growing in the future, driven by Asian demand, but more interestingly, upgrades and improvements are currently inexpensive and could help position a European downstream revival in the long term future.

From (Ernst & Young, 2012a)

333. The original logic for the integrated model was premised on the belief that it would provide a natural hedge, balanced funding and market access. Integration would allow a company to optimize the value chain and at the same time, the downstream could be seen as a source of long-term cash flow and financial stability, in contrast to more risky upstream activities. Integration enabled companies to balance their upstream and downstream activities, reducing risk and volatility. But sharply higher oil prices have shifted value creation decidedly to the upstream, often leaving downstream with low (or even negative) margins and difficult, very competitive markets.
334. Total returns for integrated companies are therefore reduced by the relatively poorer downstream performance, and thus by implication, the companies could release value to shareholders by spinning off or divesting those activities with limited integration value.
335. The vast majority of the planned expansions are national oil company (NOC) sponsored and thus less-sensitive to return pressures, with government sponsored mandates with other objectives (e.g., increasing domestic employment and inward investment, import reduction, value-added capture and/or extended foreign policy reach).
336. Other new owners may have strategies that sustain marginal plants. Depreciation will be reset, with different strategic objectives and time horizons, e.g., private equity that sees other option value. Similarly, some new market entrants may be existing refiners looking for access to new markets.
337. At the same time, alternative fuel substitution and/or refinery bypass is increasing, with more and more renewable fuels, biofuels, gas to liquids (GTLs) and natural gas liquids (NGLs) coming into the supply pool from non-refinery sources.

338. In broad terms, the higher the oil price, the more the share performance of the independents has outshone that of the integrated majors. This has led many majors to shed some (or even all) refining assets in order to concentrate on their more profitable upstream operations.
339. The last decade and a half has been one of consolidation and retrenchment by the major IOCs, a period characterized by the megamerger era and the creation of the industry giants, and then by selling and/or closing refineries in low-growth (typically OECD) markets and looking to establish footholds into heavily state-controlled, high-growth markets, typically in Asia.
340. While both ExxonMobil and Shell are divesting non-core refining, they both remain adamantly committed to large-scale refining/petrochemical integration, where they look to optimize production in order to capture the highest value output, while realizing lower costs through feedstock flexibility and sharing of infrastructure, as well as the optimization of marketing assets.
341. Financial firms, notable investment banks and private equity firms, have played a tangential role in the downstream for a long time, but their presence has been increasing in recent years. Goldman Sachs, through its J. Aron subsidiary, has long taken an interest in “hard” refining assets to leverage some of its commodity trading activities. Louis Dreyfus and Morgan Stanley have similarly taken smaller interests.
342. “Best-in-class” downstream: key competitive advantages for acceptable returns: Scale: >150 kb/d, Complexity: feedstock and output flexibility, Location: access and infrastructure (water, pipelines, terminals, storage), Location: low-cost labor, tax concessions, Location: close to demand centers, Market dynamic: product deficit, Construction cycle timing: cycle bottom, Asset integrity and reliability: maximized availability, Petrochemical integration: feedstock and infrastructure, Strong trading function: maximize feedstock/product arbitrage, routing and placement, Energy intensity: cogeneration capacity, Emissions footprint: minimized
343. Nevertheless, we do expect further portfolio optimization or rightsizing, as companies take a more rigorous view of core/non-core activities and look to reduce their exposure to lower-return assets. And similarly, we can expect to see continuing focus on innovation and operational excellence, and clearly the NOC/IOC partnership model will likely dominate the downstream in much of the growth markets.

From (Brelsford, True, & Koottungal, 2013)

344. Ineos and Petrochina pledged to build an LNG regasification terminal at the refinery (in Scotland) to accept shipments of US natural gas. This element alleviates the refinery's dependence on more expensive North Sea-produced natural gas and residual fuel oil for plant power.

From (Lal, 2014)

345. “Ineos is close to completing a tank and terminal at its Rafnes plant in Norway which will mean it will be the first place in Europe to import shale gases from the US and receive the competitive advantage of shale economics,” Ineos said.

From (A. T. Kearney, 2012)

346. In western Europe, downstream integration is the dominant model. Scale, complexity, and location are critical for ensuring a competitive edge and supply flexibility. Asset-light strategies –or pure trading under a strong brand- are preferred because the region has both liquidity in

petroleum products and good infrastructure, but is saddled by poor refining margins and inadequate raw materials base.

347. (In western Europe) Other smaller gasoline-heavy refineries are at risk. In this region, the pure merchant model is being questioned as a result of increased price volatility for both refinery inputs and outputs, as evidenced by, for example, the insolvency of Petroplus in January 2012.
348. Eastern Europe and Russia still see vertical integration as the highest priority... Meanwhile, Eastern European refiners focus on serving local market needs, with local governments securing existing market positions. This strategy may mean the industry is at a dead end.
349. Marathon Oil's spin-off of its refining operations pushed the company's stock price up 20 percent higher than that of integrated oil companies, with the upstream company assessed at three times the market value of the downstream company.
350. Eastern European and Russian refiners are investing in technologies and scale to overcome the limitations of their dated structures and to pursue asset excellence. However, infrastructure and output issues around the still-underinvested and not yet upgraded refining technology landscape are hindering integration with the local market and are favoring fuels export instead.

From (Ellis Jones, 1988)

351. Investing in storage facilities in Europe is an effective way to hedge against currency fluctuations.
352. ...requirements of Governments, the EC and the IEA on minimum levels of stocks for reasons of security of supply have prevented the industry from running down its stocks to the lowest level consistent with its operational requirements.
353. An unfavourable position in a highly competitive market, where employed capital does not provide a realistic return, is a good reason for a company to withdraw.
354. Companies should exit markets which are over-regulated, and where government actions prevent the industry from raising prices to an economically remunerative level.

From (Penrose, 1968)

355. Effective tax rates is an important driver for investments (or divestments) in the European downstream oil sector.
356. Effective tax rates is an important driver for becoming more vertically integrated nationally and/or internationally.
357. Vertical integration leads to assured outlets for crude (and a steadier and more efficient planning of crude output over time).
358. Vertical integration leads to more efficient operation of refineries (as a result of an assured and managed flow of crude oil).
359. Vertical integration leads to a more flexible and efficient adjustment to short-run changes in the demand for different products in different areas (which can then be quickly reflected in the inflows of crude oil).
360. Vertical integration leads to a more flexible and efficient adjustment to short-run changes in the demand and helps avoid disruptive fluctuations in prices of oil products (burdening both producers and consumers).
361. Companies should seek to acquire their own outlets, if they would otherwise be faced with a monopolistic combination among buyers of their product.

362. Companies should seek to acquire their own sources of crude oil, if they would otherwise be deprived of a regular flow of supplies or charged monopolistic prices.

From (Pirrong, 2014)

363. Vertical integration and downstream asset-heavy strategies, can lead to profits from the increased optionality inherent in the acquired assets.
364. Acquisition of midstream (storage, blending facilities and terminals) fixed logistic assets helps minimize transaction costs, such as “holdups”.
365. Acquisition of midstream fixed logistic assets leads to better and faster exploitation of arbitrage op-portunities (since increased price transparency and IT capabilities have decreased information asymmetries).
366. Acquisition of midstream fixed logistic assets helps to handle large volumes of new commodity flows, caused by large changes in supply and demand patterns.
367. Acquisition of midstream fixed logistic assets should be geographically dispersed, due to the economies of scale of these assets.
368. The vertical disintegration of many oil companies can be attributed to the emergence of a large number of traders, who have facilitated a liquid and competitive market for crude oil and refined products.

From (Butler, 1953)

369. Companies should acquire refineries located at their target market because the transportation cost for crude oil is lower than that for refined products.

From (Levin, 1981)

370. Research and development productivity is increased within a vertically integrated firm.

From (Al-Moneef, 1998)

371. Companies should be vertically integrated in order to spread risks.
372. Companies should be vertically integrated in order to capture value from the potential profits at many stages of the oil value chain.
373. Vertical integration abroad helps to enhance competitiveness by accessing core capabilities to enter new markets.
374. Vertical integration abroad helps boost market share.
375. Vertical integration abroad helps to forge strategic alliances for future growth.
376. The lower returns from investments downstream, than the ones from investments upstream, are a major driver for vertical disintegration downstream.

From (Kesicki, 2010)

- 377. Environmental regulations, is a major barrier for expanding or upgrading refining facilities in Europe.
- 378. Environmental regulations, is a major driver for expanding or upgrading refining facilities in Europe.
- 379. Local opposition is a major barrier for expanding or upgrading refining facilities in Europe.

From (Al-Obaidan & Scully, 1995)

- 380. Companies should expand in refining into foreign markets, because they can spread the high initial investment of fixed assets, R&D and advertising expenses.

From (Mariti & Smiley, 1983)

- 381. A company which lacks skills and capabilities in a specific business within the oil value chain, should seek to acquire assets in order to access them, instead of trying to develop them from scratch.
- 382. Technology exchanging or sharing is a major reason for a partnership (JV/consortia) between firms with a different background in the oil industry (technological complementarity).
- 383. Economies of scale, is a major reason for a partnership (JV/consortia) between firms positioned in different stages of the oil products value chain.

From (Al-Obaidan & Scully, 1993)

- 384. Due to asset specificity and volume uncertainty in the oil refining business, hierarchical governance is preferred.

## Bibliography

A. T. Kearney. (2012). *Refining 2021: Who will be in the game?* A.T. Kearney, Inc.

Accenture. (2012). *Contemporary approaches to asset investments in the energy industry*. Accenture.

Al-Moneef, M. A. (1998, June). Vertical integration strategies of the national oil companies. *The Developing Economies*, XXXVI(2), 203-222.

Al-Obaidan, A. M., & Scully, G. W. (1993). The economic efficiency of backward vertical integration in the international petroleum refining industry. *Applied Economics*, 25(12), 1529-1539.

Al-Obaidan, A. M., & Scully, G. W. (1995). The theory and measurement of the net benefits of multinationality: the case of the international petroleum industry. *Applied Economics*, 27(2), 231-238.

Amiel, G. (2014, February 5). *European Oil Refiners See Bleak Year*. Retrieved from The Wall Street Journal: <http://online.wsj.com/news/articles/SB10001424052702304680904579364140320212368>

- Ascher, J., Laszlo, P., & Quiviger, G. (2012). *Commodity trading at a strategic crossroad*, McKinsey Working Papers on Risk No. 39. McKinsey & Company.
- Bakhsh, N. (2011, February 25). *Europe's Growing Diesel Deficit to Boost Storage, Woodmac Says*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2011-02-25/europe-s-growing-diesel-deficit-to-boost-storage-woodmac-says.html>
- Bakhsh, N., & Klump, E. (2010, July 22). *ConocoPhillips May Close German Refinery After Writing Off \$1.1 Billion*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2010-07-22/conocophillips-may-close-german-refinery-after-writing-off-1-1-billion.html>
- Beddoes, C., & EUROPIA. (2010). *Perspectives for the Downstream Oil Business in Europe, Presentation at the 2nd Energy Community Forum, Belgrade, November 2010*. EUROPIA.
- Brelsford, R., True, W., & Koottungal, L. (2013, December 2). *Western Europe leads global refining contraction*. Retrieved from Oil & Gas Journal: <http://www.ogj.com/articles/print/volume-111/issue-12/special-report-worldwide-report/western-europe-leads-global-refining-contraction.html>
- Business Monitor News and Views. (2013, October 9). *Mantova Conversion Highlights Ailing European Refining Sector*. Retrieved from Oil and Gas Insight : <http://www.oilandgasinsight.com/industry-news-mantova-conversion-highlights-ailing-european-refining-sector-jan-2014>
- Butler, J. D. (1953, July). The Influence of Economic Factors on the location of Oil Refineries. *The Journal of Industrial Economics*, 1(3), 187-201.
- Carlyle Group and Vito Group. (2013, December 19). *Carlyle Group and Vito Group establish midstream Varo Energy*. Retrieved from Oil & Gas Financial Journal: <http://www.ogfj.com/articles/2013/12/carlyle-group-and-vito-group-establish-midstream-varo-energy.html>
- Chazan, G. (2014, April 30). *Total profits hit by weaker refining margins and lower production*. Retrieved from Financial Times: <http://www.ft.com/intl/cms/s/0/2b981154-d06c-11e3-af2b-00144feabdc0.html>
- Cole, C. (2011, November 1). *Evolution in energy trading highlights need for improved risk management skills*. Retrieved from Oil & Gas Financial Journal: <http://www.ogfj.com/articles/2011/11/evolution-in-energy-trading-highlights-need.html>
- Cooper, S. & Wood Mackenzie. (2013). *Crude Oil in Europe: Production, Trade and Refining Outlook; Presentation at StocExpo-Antwerp, March 2013*. London: Wood Mackenzie.
- Cuthbert, N., Leavens, J., Kennaby, D., & Birch, C. (2011). *Developments in the international downstream oil markets and their drivers: implications for the UK refining sector*. Purvin & Gertz, Inc.
- Dison, J. (2011, February 1). *The future of supply trading in the oil and gas industry*. Retrieved from Oil & Gas Financial Journal: <http://www.ogfj.com/articles/print/volume-8/issue-2/features/the-future-of-supply-trading-in-the-oil.html>
- Elliot, S. (2013, December 23). *Europe's refining moment*. Retrieved from Platts.com: [https://www.platts.com/IM.Platts.Content%5Caboutplatts%5Cmediacenter%5Cpdf%5Cinsightdec13\\_refining.pdf](https://www.platts.com/IM.Platts.Content%5Caboutplatts%5Cmediacenter%5Cpdf%5Cinsightdec13_refining.pdf)

- Ellis Jones, P. (1988). *Oil: A practical guide to the economics of world petroleum*. Cambridge: Woodhead-Faulkner Ltd.
- Ernst & Young. (2012a). *The oil downstream: vertically challenged?* EYGM Limited.
- Ernst & Young. (2012b). *Overcoming the challenges of implementing NOC globalization ambitions*. EYGM Limited.
- Ernst & Young. (2013a). *Global oil and gas transactions review 2012*. EYGM Limited.
- Ernst & Young. (2013b). *National Oil Company Monitor Q4 2012*. EYGM Limited.
- Ernst & Young. (2014). *Global oil and gas transactions review 2013*. EYGM Limited.
- EurActiv.com, Reuters. (2014, May 23). *Russian strategy to buy up Europe's refineries exposed*. Retrieved from EurActiv.com: <http://www.euractiv.com/sections/energy/russian-strategy-buy-europes-refineries-exposed-302329>
- Fattouh, B., & Mallinson, R. (2013). *Refining Dynamics in the GCC and Implications for Trade Flows*. Oxford: The Oxford Institute for Energy Studies.
- Fielden, S. (2013, July 18). *Where the crudes have no margins – European refinery woes*. Retrieved from Oil & Gas Financial Journal: <http://www.ogfj.com/articles/2013/07/where-the-crudes-have-no-margins-european-refinery-woes.html>
- Gismatullin, E. (2014, April 30). *Shell Writes Off \$2.3 Billion Refining Assets as Asia Adds Units*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2014-04-30/shell-writes-off-2-3-billion-refining-assets-as-asia-adds-units.html>
- Guarerra, L. (2008). Mediterranean gasoline surplus and diesel shortage: the impending conversion bottleneck. *OPEC Energy Review March 2008*, 88-104.
- Holter, M. (2014, January 13). *Shell to Sell Norwegian Downstream Assets to Meet Spending Goal*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2014-01-13/shell-to-sell-norwegian-downstream-assets-to-meet-spending-goal.html>
- Hureau, G., Serbutoviez, S., Silva, C., & Maisonnier, G. (2013). *Investment in exploration-production and refining 2013*. IFP Énergies nouvelles.
- IEA. (2008). *Medium-Term Oil Market Report*. Paris: OECD/IEA.
- IEA. (2009). *Medium-Term Oil Market Report*. Paris: OECD/IEA.
- IEA. (2011). *Medium-Term Oil & Gas Markets 2011*. Paris: OECD/IEA.
- IEA. (2012). *Oil: Medium-Term Market Report 2012*. Paris: OECD/IEA.
- Kemp, J. (2013, November 29). *COLUMN-Facing a Kodak moment, EU oil refiners must invest or die*. Retrieved from Reuters: <http://uk.reuters.com/article/2013/11/29/eu-refining-idUKL5N0JE1W620131129>
- Kesicki, F. (2010). The third oil price surge - What's different this time? *Energy Policy*, 38, 1596-1606.

- Kirchfeld, A., Comfort, N., & Campbell, M. (2012, July 5). *Exxon Mobil Said to Explore Sale of German Gas Stations*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2012-07-04/exxon-mobil-said-to-explore-sale-of-german-esso-gas-stations.html>
- KPMG. (2012). *The Future of the European Refining Industry*. KPMG LLP.
- Lal, N. (2014, January 10). *Will Europe's petrochemical industry follow the fate of oil refining?* Retrieved from Platts.com: <http://www.platts.com/news-feature/2014/petrochemicals/europe-2014-outlook/index>
- Levin, R. C. (1981). Vertical Integration and Profitability in the Oil Industry. *Journal of Economic Behavior and Organization*, 2(3), 215-235.
- Loder, A. (2014, January 8). *Unforeseen U.S. Oil Boom Upends Markets as Drilling*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2014-01-08/unforeseen-u-s-oil-boom-upends-world-markets-as-drilling-spreads.html>
- Mariti, P., & Smiley, R. H. (1983, June). Co-Operative Agreements and the Organization of Industry. *The Journal of Industrial Economics*, 31(4), 437-451.
- Migliaccio, A. (2014, April 29). *Eni Profit Falls on Weak Demand and Declining Refining Margins*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2014-04-29/eni-profit-falls-on-weak-demand-and-declining-refining-margins.html>
- Nguyen, L., & Voss, S. (2012, March 28). *Vitol CEO Says Atlantic Refinery Closings Spur Long-*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2012-03-28/vitol-ceo-says-atlantic-refinery-closings-spur-long-distance-oil.html>
- Oil & Gas Financial Journal. (2009, November 10). *Multinationals on the move - refineries on the up in Asia Pacific*. Retrieved from Oil & Gas Financial Journal: <http://www.ogfj.com/articles/2009/11/multinationals-on.html>
- Oil & Gas Financial Journal. (2010, November 29). *Purvin & Gertz Launches Global Crude Oil Market Outlook*. Retrieved from Oil & Gas Financial Journal: [http://www.ogfj.com/articles/2010/11/purvin-gertz\\_launches.html](http://www.ogfj.com/articles/2010/11/purvin-gertz_launches.html)
- Oil & Gas Financial Journal. (2012, March 21). *Oil companies exiting refining business*. Retrieved from Oil & Gas Financial Journal: <http://www.ogfj.com/articles/2012/03/oil-companies-exiting-refining-business.html>
- Oil & Gas Journal Editors. (2014, April 7). *Moody's: Global refining, marketing industry to see earnings rise this year*. Retrieved from Oil & Gas Journal: <http://www.ogj.com/articles/2014/04/moody-s-global-refining-marketing-industry-to-see-earnings-rise-this-year.html>
- Oil and Energy Trends. (2010, August). OECD's refiners face future of refinery cuts. *Oil and Energy Trends*, 35(8), 3-6.
- Oil and Energy Trends. (2011a, June). Europe's refiners face bleak future. *Oil and Energy Trends*, 36(6), 13-14.

Oil and Energy Trends. (2011b, November). Refinery shake-out looms in Atlantic Basin. *Oil and Energy Trends*, 36(11), 3-6.

Oil and Energy Trends. (2012a, July). Europe struggles to balance refinery slate. *Oil and Energy Trends*, 37(7), 3-6.

Oil and Energy Trends. (2012b, October). Signs of US refining revival as Europe remains in doldrums. *Oil and Energy Trends*, 37(10), 13-14.

Oil and Energy Trends. (2012c, February). World refining: Western decline vs. Eastern growth. *Oil and Energy Trends*, 37(2), 10-17.

Oil and Energy Trends. (2013, August). Europe's refiners face further closures as demand falls and competition grows. *Oil and Energy Trends*, 38(8), 10-18.

Oil and Energy Trends. (2013b, June). Unions protest as another French refinery closes. *Oil and Energy Trends*, 38(6), 10.

Oil and Energy Trends. (2014, March). European refinery closures continue as foreign competition increases. *Oil and Energy Trends*, 39(3), 3-6.

Patel, T. (2010, October 29). *Total Profit Climbs 32% as Fields Come On Stream, Price of Oil Increases*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2010-10-29/total-profit-climbs-32-as-fields-come-on-stream-price-of-oil-increases.html>

Patel, T. (2013, September 4). *Total to Shut French Steam Cracker in Switch to Resins*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2013-09-04/total-to-shut-french-steam-cracker-at-carling-in-switch-to-resin.html>

Patel, T., & Gismatullin, E. (2013, September 23). *Total Sees Output Increase Through 2017 as Spending Peaks*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2013-09-23/total-sees-production-increase-through-2017-as-spending-peaks.html>

Patel, T., & Swint, B. (2012, September 25). *Total May Look to North Sea, Africa for \$20 Billion in*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2012-09-25/total-may-look-to-north-sea-africa-for-20-billion-in-sales-2-.html>

Penrose, E. T. (1968). *The Large International Firm in Developing Countries: The International Petroleum Industry* (1st edition ed.). London, U.K.: George Allen and Unwin Ltd.

Pirrong, G. (2014). *The Economics of Commodity Trading Firms*. Craig Pirrong & Trafigura.

Resnick-Ault, J., & McCracken, J. (2011, March 10). *Valero Said to Buy Chevron's U.K. Refinery for \$2*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2011-03-10/valero-said-to-buy-chevron-u-k-refinery-for-about-2-billion.html>

Rozhnov, K. (2013, April 5). *Europe to Shut 10 Refineries as Profits Tumble*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2013-04-04/europe-to-shut-10-refineries-as-profits-tumble.html>

Rozhnov, K., & Gross, J. (2012, June 7). *Investment in West's Refineries Isn't All Good News*. Retrieved from The Wall Street Journal: <http://online.wsj.com/news/articles/SB10001424052702303665904577452162526770508>

- Rudnitsky, J. (2012, September 20). *Gunvor Is 'Major Force' in Russia After Rosneft Tender Loss*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2012-09-20/gunvor-to-stay-major-force-in-russia-after-rosneft-tender-loss.html>
- Rudnitsky, J., & Shiryayevskaya, A. (2012, October 31). *Gunvor Wins Rosneft One-Year Oil Contract; More May Follow*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2012-10-31/gunvor-wins-rosneft-s-one-year-tender-to-export-oil-products-1-.html>
- Smith, G. (2013, February 28). *Vitol's Energy Trading Revenue Rose 2% to \$303*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2013-02-28/vitol-s-energy-trading-revenue-rose-2-to-303-billion-in-2012.html>
- Sykes, L. (2013, October 22). *The new global refining centres*. Retrieved from Arabian Oil and Gas.com: <http://www.arabianoilandgas.com/article-11498-the-new-global-refining-centres/>
- Tirone, J. (2013, December 19). *Carlyle-Vitol Venture to Buy Bayernoil Refinery Stake*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2013-12-19/carlyle-vitol-venture-to-buy-bayernoil-refinery-stake.html>
- Tirone, J., & Bergman, J. (2013, August 19). *OMV Pays Record \$2.65 Billion for Statoil North Sea Oil, Gas*. Retrieved from Bloomberg: <http://www.bloomberg.com/news/2013-08-19/omv-pays-record-2-65-billion-to-statoil-for-north-sea-oil-gas.html>
- Werber, C. (2013, September 19). *European Refining Is Urged to Shrink Further*. Retrieved from The Wall Street Journal: <http://online.wsj.com/news/articles/SB10001424127887323808204579084860226698406>
- Young, M., & Mumby, H. (2013, August 7). *Big oil struggles in Q2 2013*. Retrieved from Oil & Gas Financial Journal: <http://www.ogfj.com/articles/2013/08/big-oil-struggles-in-q2-2013.html>

## Appendix C: Items list after 1<sup>st</sup> refinement round

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The 83 items which resulted from the initial list of 384 items after the 1<sup>st</sup> refinement round are presented below.

1. Effective tax rates are an important driver for investments in the European downstream oil sector.
2. Effective tax rates are an important driver for divestments in the European downstream oil sector.
3. The higher taxes on emissions in Europe are a driver for investments in the refining sector.
4. The higher taxes on emissions in Europe are a driver for divestments of refining assets.
5. The new hydrodesulphurization capacity of the Russian refining sector is a barrier for investments in the European refining sector, especially in Southern Europe.
6. The new hydrodesulphurization capacity of the Russian refining sector is a driver for investments in the European refining sector, especially in Southern Europe.
7. European refiners cannot compete with their Russian competitors, as the latter can benefit from a more favorable export-tax regime, and this is a main reason for divestments in the European refining sector.
8. The dependence on Russian crude oil, combined with the acquisitions of European refineries by Russian companies, may lead to a refinery industry vulnerable to political interference.
9. Acquisitions of less profitable downstream oil assets in Europe by certain companies, might be justified for reasons of extended foreign policy reach through energy market control.
10. Political pressure by governments and labor unions is an important barrier for divestments in the European downstream oil sector.
11. Acquisitions of refineries in Europe, is a good way to secure downstream outlets for your crude oil production and have a more efficient planning of output over time.
12. The acquisition of refineries and their transformation to terminals, often to be used for imports of refined products, is a serious issue for the European energy security.
13. Retaining sufficient refining capacity is a key factor for Europe's energy security, and this should be a barrier for further divestments in the region's downstream oil sector.
14. Small, old, unsophisticated, gasoline-making refineries, which are located in inland markets with few export opportunities, cannot compete effectively in Europe and should be divested.
15. The pressure on refiners from Brussels and national governments, to curb future increases in their output selling prices, is an important driver for divestments in the refining sector.
16. Environmental regulations in Europe are a major barrier for expanding or upgrading refining facilities and lead refiners to cost-cutting measures and/or divestments of plants.
17. Environmental regulations in Europe are a major driver for expanding or upgrading refining facilities.
18. Most European refineries are configured to produce gasoline, however the European market demands more middle distillates, which is a major driver for upgrading investments in refineries.
19. Most European refineries are configured to produce gasoline, however the European market demands more middle distillates, which is major driver for divestments of refineries.
20. The fall of demand for gasoline in the US market (partly due to the greater use of ethanol in the gasoline pool) is a significant driver for investments in the European downstream oil sector.

21. The fall of demand for gasoline in the US market (partly due to the greater use of ethanol in the gasoline pool) is a significant driver for divestments in the European downstream oil sector.
22. There is substantial surplus of refining capacity in (Eastern) Europe, leading to low utilization rates, and this is a major barrier for new investments in the refining sector.
23. The declining demand in Europe and the increased competition to supply the European market, have led to a surplus of refining capacity and this is a good reason for exiting the refining business.
24. The surplus of gasoline in the European market is an important barrier for new investments in the European downstream oil sector.
25. The surplus of gasoline in the European market is an important driver for new investments in the European downstream oil sector.
26. The EC mandates for biofuels contribution of fuel by 2020, created the necessity to invest (with low return) in tankage and blending facilities, and this was a major driver for divesting refineries in general.
27. Major drivers for divestment of crude oil refineries in Europe are the renewable fuels, biofuels, gas to liquids (GTLs) and natural gas liquids (NGLs) coming into the supply pool from non-refinery sources.
28. The EC mandates for biofuels contribution of fuel by 2020 is a major driver for investments in the European downstream oil sector.
29. The mature European downstream market, makes it better for a company to divest downstream assets in Europe and refocus on its downstream presence in growth markets.
30. Refiners should invest more in chemical operations, as they will be able to offer a broader slate of products, which can cushion against market-demand swings for fuel products.
31. A major driver for investments in the European downstream oil sector is the growth of future petrochemical demand, mainly in Asia, combined with the (currently) inexpensive upgrades required.
32. The difficulty to access credit is a major barrier for investments in the European downstream oil sector.
33. Exploration for and production of crude oil become more expensive and a good way to ensure capital for investments upstream, is to divest less profitable and capital-intensive downstream activities.
34. The lower returns from investments downstream, than the ones from investments upstream (crude oil production), are a major driver for divestments of downstream assets in Europe.
35. The most significant barriers to closing a refinery are environmental costs, the demolition work, employee compensation costs and even legal costs in case of disputes with other stakeholders.
36. Major reasons for converting unprofitable refineries to terminals are mitigation of (potential) closure costs, extension of the asset's useful life, reduction of the plant costs and release of working capital.
37. The higher freight costs for moving refined products to Europe from outside the region, than the costs for moving crude oil, is a major reason for investments in refineries located in Europe.
38. A major driver for converting a refinery into a storage terminal is cost-effectiveness, as most of the necessary infrastructure (logistics network, pipelines, storage units) is already in place.
39. The Compulsory Stock Obligation (CSO) represents a cost for the industry, as it does not allow it to run down its stocks to the lowest level consistent with its operational requirements.
40. Acquisition of midstream (storage, blending facilities and terminals) fixed logistic assets helps minimize numerous transaction costs, like the ones due to deliberate "holdups".
41. A major reason for acquiring refineries and/or storage facilities in Europe, is the region's strategic location which offers global connectivity and increased trading potential.

42. A major reason for acquiring European refineries and converting them to storage facilities for trading purposes, is that an established site simplifies compliance for environmental regulations.
43. A major reason for acquiring storage facilities or converting refineries to storage in Europe is contango storage.
44. A major reason for acquiring storage facilities or converting refineries to storage in Europe is compliance with compulsory stock obligations.
45. Acquisition of midstream fixed logistic assets leads to better and faster exploitation of arbitrage opportunities.
46. Changes in supply and demand patterns in Europe is a major reason for acquisitions of storage facilities or conversion of refining facilities into storage in the region, to help handle the new commodity flows.
47. Beyond 2018, a further decline in North Sea production will lead to increased crude import and storage requirements in Europe, and this is a major driver for investments in crude storage assets.
48. The declining North Sea production and Urals availability, combined with increased future availability of BTC and CPC blends, is a good reason to invest in changing the European refineries configuration.
49. The declining North Sea production and Urals availability, combined with increased future availability of BTC and CPC blends, is a reason for exiting the refining business in Europe.
50. Major drivers behind acquisitions of refineries, tankage and other physical assets in Europe, are strategies aiming to spread risks and overheads, and hedge against currency fluctuations.
51. A major driver for acquiring refineries in Europe is that you can gain a foothold in the region, without having to invest huge capital as many refineries are for sale at favorable prices.
52. The EU import tariffs on diesel are due to be raised by 3.5% from January 1, 2014, and this is a major driver for investments in European refineries in order to increase production of diesel.
53. A major reason for divestments in the European refining sector is the loss of market share of Europe's refiners in the US, Africa and Latin America, from refiners in Asia, Middle East and the US.
54. A major reason for exiting the refining business in Europe is the strong labor laws and high wages.
55. Refining capacity closures are difficult in areas where there is little or no economic growth and high unemployment.
56. Investments in the European refining sector are important for job creation purposes.
57. Local opposition is a major barrier for expanding or upgrading refining facilities in Europe.
58. The low price of US shale gas is a major driver for investments in LNG regasification terminals in European refineries, in order to use it for plant power and exploiting the advantages of shale economics.
59. The higher feedstock and fuel costs of European refiners compared to their US counterparts, are a major driver for divestments in the European refining sector.
60. The higher feedstock and fuel costs of European refiners compared to their US counterparts, are a major driver for investments in the European refining sector.
61. European refineries cannot compete with the new refineries in Asia and Middle East, as the latter are of high complexity and scale, and this is a major driver for upgrading investments in European refineries.
62. European refineries cannot compete with the new refineries in Asia and Middle East, as the latter are of high complexity and scale, and this is a major driver for divestments of refineries in Europe.
63. The rise of financing and transaction costs due to regulatory changes in the banking and derivatives- trading environment, creates business opportunities for asset-heavy firms.
64. Spinning-off the refining operations can boost a company's stock price, especially when it has valuable upstream operations.

65. A major reason for divesting downstream assets is to increase the outlook for future cash flows and increase dividend payments to shareholders.
66. A major driver for acquiring downstream assets in Europe is because is a good alternative way to help to serve the growing demand for fuels in Asian countries.
67. The JVs of European oil companies in the refining sector of foreign countries, help them shut refinery capacity in Europe and supply their wholesale and retail networks with products from these countries.
68. The “National” status of specific European companies acts a barrier to divestments of uneconomic or poorly performing assets in their home markets.
69. The rationale behind asset restructuring and/or diversification with assets in the European downstream oil sector, has to do with accessing the European market.
70. A major driver for investing in the European downstream oil sector is to access, exchange or share technology, potentially through partnerships with firms with a different oil-business background.
71. Asset light strategies are preferred in Western Europe, due to the region’s liquidity in petroleum products, good infrastructure, low refining margins and inadequate raw materials base.
72. The low levels of profitability and weak corporate balance sheets, are serious barriers for investments in installations of new hydrocracking and/or other expensive processing units.
73. The vertical disintegration of many oil companies can be attributed to the emergence of a large number of traders, who have facilitated a liquid and competitive market for crude oil and refined products.
74. An important reason for getting involved in trading is to gain knowledge of the full value chain and therefore, help for smarter upstream and downstream capital investments.
75. The ownership of midstream physical assets and the creation of end-to-end supply chains open opportunities to gain access to exclusive and unpublished market information.
76. The current oversupply in the market will end, as smaller refineries close, therefore acquisitions of refineries in Europe can be justified.
77. Creating a competitive advantage through innovation and research is a good reason for investing in a loss-making refinery in order to transform it into a technological hub.
78. Divestments of refineries decrease exposure to the downstream segment, where there is higher volatility.
79. A major reason for acquiring assets in the European downstream oil sector is for accessing new skills and capabilities in specific business within the oil value chain, for example oil products marketing.
80. A major reason for acquiring midstream assets in Europe is the increasing products with different specifications to comply with regulations, requiring increased segregated storage and blending facilities.
81. A major reason for acquiring storage facilities or converting refining facilities into storage, in Europe, is the increasing activity from independent retailers/distributors and hypermarkets.
82. An important reason for investing in the European downstream market is for diversifying activities in order to reduce exposure to commodity price volatility.
83. The ownership of midstream physical assets helps a company to provide turnkey services such as fuel supply and conversion into power for smaller nations.

## Appendix D: Q methodology research data sheet sample

[illegible]

## Appendix E: Differences and similarities between Principal Component Analysis and Factor Analysis

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Factor Analysis (FA) techniques are “... statistical techniques applied to a single set of variables when the researcher is interested in discovering which variables in the set form coherent subsets that are relatively independent of one another. Variables that are correlated with one another but largely independent of other subsets of variables are combined into factors.” (Tabachnick & Fidell, 2007, p. 607). Principal Component Analysis (PCA) is often referred to as a FA technique, since it is a variables-reduction technique aiming to “identify” principal components which account for most of the variance of the observed variables (Brown J. D., 2009); (Suhr, 2005). In the case of this research, the variables are the individual Q sorts prepared by the participants. However, PCA is not, strictly speaking, FA and the components are not factors, such as the ones generated by CFA (Watts & Stenner, 2012). There are conceptual differences between PCA and FA (so also CFA), but also mathematical differences in the way they “generate” the correlation matrix and extract the “factors”. These differences will not be elaborated at this point since this is out of the scope of this research. The only remark that will be made is that while PCA takes into consideration all three types of variance (common, specific and error), FA focuses only on common variance (covariance) (Brown J. D., 2009). Common variance refers to the proportion of variability of a Q sort or study which is held in common with, or by, the rest of the group (of Q sorts), specific variance refers to variance of particular Q sorts and finally, error variance refers to the variance produced by random errors (Watts & Stenner, 2012). For these reasons, PCA is more appropriate for researchers who want to “explore” for general patterns in the data, without having a theory about the relationships among variables. On the contrary, FA is better to be used when such a well-grounded theory exists and the researcher wants to discover more about these relationships (Brown J. D., 2009). Nevertheless, the two techniques for variables-reduction (finding “typical” Q sorts/factors), usually generate quite similar results in practice (Harman, *Modern Factor Analysis*, 1976).

### Bibliography

- Brown, J. D. (2009). Principal components analysis and exploratory factor analysis - Definitions, differences, and choices. *Shiken: JALT Testing & Evaluation SIG Newsletter*, 13(1), 26-30.
- Harman, H. H. (1976). *Modern Factor Analysis* (3rd ed.). Chicago: University of Chicago Press.
- Suhr, D. D. (2005, April 10-13). Principal Component Analysis vs. Exploratory Factor Analysis. *SUGI 30 Proceedings*, 203-30.
- Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Upper Saddle River, NJ: Pearson Allyn & Bacon.
- Watts, S., & Stenner, P. (2012). *Doing Q Methodological Research*. London: SAGE Publications Ltd.

## Appendix F: Other tables generated by the PQMethod software

This Appendix contains all the tables generated by the PQMethod software, which were not presented in the main report.

**Table 1: The unrotated factor matrix.**

| Q Sorts            |               | Factors |         |         |         |         |         |         |         |
|--------------------|---------------|---------|---------|---------|---------|---------|---------|---------|---------|
|                    |               | 1       | 2       | 3       | 4       | 5       | 6       | 7       | 8       |
| 1                  | Vesta Term.   | 0.5871  | -0.1614 | -0.4064 | 0.5311  | 0.0784  | 0.0399  | 0.2612  | -0.0529 |
| 2                  | CIEP          | 0.8012  | 0.0051  | -0.1425 | -0.0806 | -0.0511 | -0.2541 | 0.2491  | -0.037  |
| 3                  | Q8            | 0.4208  | 0.2038  | 0.6754  | -0.0952 | -0.3506 | 0.0755  | 0.2943  | 0.2388  |
| 4                  | Min. Ec. Aff. | 0.625   | -0.1266 | 0.225   | 0.0783  | 0.4868  | -0.1784 | -0.0527 | 0.4299  |
| 5                  | Shell         | 0.5776  | 0.4461  | -0.228  | -0.2238 | 0.1782  | 0.3475  | 0.3076  | -0.1107 |
| 6                  | COVA          | 0.7876  | 0.1032  | -0.1257 | -0.1142 | -0.2835 | 0.2922  | -0.1188 | 0.0874  |
| 7                  | ExxonMobil    | 0.7047  | -0.1651 | 0.1475  | -0.2615 | -0.2047 | -0.078  | -0.264  | -0.2936 |
| 8                  | EC/DG-En.     | 0.4319  | 0.5405  | 0.3592  | 0.0206  | 0.4209  | -0.1907 | -0.0841 | -0.3087 |
| 9                  | FuelsEurope   | 0.4117  | -0.635  | 0.2119  | -0.2261 | 0.3433  | 0.3581  | 0.0451  | -0.135  |
| 10                 | BP            | 0.7577  | -0.2007 | -0.2358 | -0.2218 | 0.0132  | 0.0197  | -0.2003 | 0.1777  |
| 11                 | Cons. Firm    | 0.7086  | 0.4168  | -0.2616 | 0.1052  | -0.0498 | -0.0329 | -0.2912 | 0.1278  |
| 12                 | Hestya        | 0.494   | -0.0927 | 0.358   | 0.6701  | -0.1313 | 0.2372  | -0.1502 | -0.1146 |
| 13                 | TU Delft      | 0.6521  | -0.3191 | -0.0009 | -0.0091 | -0.1997 | -0.4444 | 0.1659  | -0.1322 |
| <b>Eigenvalues</b> |               | 5.1062  | 1.3404  | 1.2078  | 0.9962  | 0.8775  | 0.7357  | 0.5822  | 0.5441  |
| <b>% expl.Var.</b> |               | 39      | 10      | 9       | 8       | 7       | 6       | 4       | 4       |

The factor loadings are expressed in the form of correlation coefficient of every Q sort with every unrotated factor (before Varimax rotation takes place).

**Table 2: Cumulative communalities matrix.**

| Q sorts |               | Factors |        |        |        |        |        |        |        |
|---------|---------------|---------|--------|--------|--------|--------|--------|--------|--------|
|         |               | 1       | 2      | 3      | 4      | 5      | 6      | 7      | 8      |
| 1       | Vesta Term.   | 0.3446  | 0.3707 | 0.5358 | 0.8179 | 0.824  | 0.8256 | 0.8938 | 0.8966 |
| 2       | CIEP          | 0.642   | 0.642  | 0.6623 | 0.6688 | 0.6714 | 0.736  | 0.798  | 0.7993 |
| 3       | Q8            | 0.1771  | 0.2186 | 0.6748 | 0.6838 | 0.8067 | 0.8124 | 0.899  | 0.9561 |
| 4       | Min. Ec. Aff. | 0.3906  | 0.4067 | 0.4573 | 0.4634 | 0.7004 | 0.7322 | 0.735  | 0.9198 |
| 5       | Shell         | 0.3336  | 0.5326 | 0.5846 | 0.6346 | 0.6664 | 0.7871 | 0.8818 | 0.894  |
| 6       | COVA          | 0.6203  | 0.631  | 0.6468 | 0.6598 | 0.7402 | 0.8255 | 0.8397 | 0.8473 |

|                          |             |        |        |        |        |        |        |        |        |
|--------------------------|-------------|--------|--------|--------|--------|--------|--------|--------|--------|
| 7                        | ExxonMobil  | 0.4966 | 0.5239 | 0.5456 | 0.614  | 0.6559 | 0.662  | 0.7317 | 0.8179 |
| 8                        | EC/DG-En.   | 0.1865 | 0.4787 | 0.6077 | 0.6081 | 0.7853 | 0.8217 | 0.8287 | 0.924  |
| 9                        | FuelsEurope | 0.1695 | 0.5727 | 0.6176 | 0.6687 | 0.7866 | 0.9148 | 0.9169 | 0.9351 |
| 10                       | BP          | 0.574  | 0.6143 | 0.6699 | 0.7191 | 0.7193 | 0.7197 | 0.7598 | 0.7914 |
| 11                       | Cons. Firm  | 0.5021 | 0.6758 | 0.7443 | 0.7553 | 0.7578 | 0.7589 | 0.8437 | 0.86   |
| 12                       | Hestya      | 0.244  | 0.2526 | 0.3808 | 0.8299 | 0.8471 | 0.9034 | 0.9259 | 0.9391 |
| 13                       | TU Delft    | 0.4252 | 0.5271 | 0.5271 | 0.5271 | 0.567  | 0.7645 | 0.7921 | 0.8095 |
|                          |             |        |        |        |        |        |        |        |        |
| <b>Cum. % expl. Var.</b> |             | 39     | 50     | 59     | 67     | 73     | 79     | 83     | 88     |

The right-hand column of this table (column “Factor 8”) shows how much of the variance in each Q sort has been explained by the 8 study factors in total. It shows how much a Q sort holds in common with the other Q sorts (Watts & Stenner, 2012).

**Table 3: The rotated factor matrix.**

| Q Sorts            |               | Loadings |         |         |
|--------------------|---------------|----------|---------|---------|
|                    |               | 1        | 2       | 3       |
| 1                  | Vesta Term.   | 0.4019   | 0.5773  | -0.2026 |
| 2                  | CIEP          | 0.458    | 0.6524  | 0.1641  |
| 3                  | Q8            | 0.2359   | 0.0074  | 0.7868X |
| 4                  | Min. Ec. Aff. | 0.5241X  | 0.2652  | 0.335   |
| 5                  | Shell         | -0.0334  | 0.7278X | 0.232   |
| 6                  | COVA          | 0.3779   | 0.6748X | 0.2205  |
| 7                  | ExxonMobil    | 0.5870X  | 0.3491  | 0.2814  |
| 8                  | EC/DG-En.     | -0.078   | 0.335   | 0.6996X |
| 9                  | FuelsEurope   | 0.7802X  | -0.0945 | 0.0045  |
| 10                 | BP            | 0.5703   | 0.5865  | -0.0257 |
| 11                 | Cons. Firm    | 0.0624   | 0.8275X | 0.2359  |
| 12                 | Hestya        | 0.4445   | 0.1118  | 0.4132  |
| 13                 | TU Delft      | 0.6431X  | 0.3296  | 0.0694  |
|                    |               |          |         |         |
| <b>% expl.Var.</b> |               | 21       | 25      | 13      |

The details about this table have been discussed in paragraph [4.4.1](#) of the report. One more comment here is that the Q sorts which are used to “define” a factor are flagged with an X.

**Table 4: Free distribution data results.**

|   | Q Sort          | Mean | St. Dev. |
|---|-----------------|------|----------|
| 1 | Vesta Terminals | 0    | 2.750    |
| 2 | CIEP            | 0    | 2.750    |
| 3 | Q8              | 0    | 2.750    |

|    |                 |   |       |
|----|-----------------|---|-------|
| 4  | Min. Econ. Aff. | 0 | 2.750 |
| 5  | Shell           | 0 | 2.750 |
| 6  | COVA            | 0 | 2.750 |
| 7  | ExxonMobil      | 0 | 2.750 |
| 8  | EC/DG-En.       | 0 | 2.750 |
| 9  | FuelsEurope     | 0 | 2.750 |
| 10 | BP              | 0 | 2.750 |
| 11 | Cons. Firm      | 0 | 2.750 |
| 12 | Hestya          | 0 | 2.750 |
| 13 | TU Delft        | 0 | 2.750 |

Table 5: Factor scores with corresponding ranks.

| No. | Statement                                                                                                                                                                                                       | No. | Factors |    |       |    |       |    |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---------|----|-------|----|-------|----|
|     |                                                                                                                                                                                                                 |     | 1       | 2  | 3     | 4  | 5     | 6  |
| 1   | The growing competition European refiners face from their Russian counterparts in the European market, works mostly as an incentive for upgrading investments in European refineries.                           | 1   | -0.59   | 32 | -1.60 | 41 | 0.18  | 16 |
| 2   | The fall of demand for gasoline in the US market is a significant driver for divestments in the European downstream oil sector.                                                                                 | 2   | 0       | 17 | 1.72  | 2  | 1.43  | 6  |
| 3   | A major driver for acquiring downstream assets in Europe is because is a good way to help to serve the growing demand for fuels in Asian countries.                                                             | 3   | -1.23   | 37 | -2.15 | 42 | -0.81 | 37 |
| 4   | Effective tax rates in Europe is an important driver for divestments in the European downstream oil sector.                                                                                                     | 4   | -0.36   | 29 | -1.08 | 36 | -0.63 | 30 |
| 5   | The high taxes on emissions in Europe is a major driver for divestments of refining assets.                                                                                                                     | 5   | 0.89    | 8  | 0.12  | 19 | -1.52 | 40 |
| 6   | Changes in supply and demand patterns in Europe is a major reason for acquisitions of storage facilities or conversion of refining facilities to storage in the region, to help handle the new commodity flows. | 6   | 0.61    | 11 | 2.03  | 1  | -0.71 | 31 |
| 7   | The need to comply with the European environmental legislation (including biofuels mandates), works mostly as an incentive for upgrading investments in refineries.                                             | 7   | -1.53   | 41 | 0.34  | 17 | 0.98  | 9  |
| 8   | Acquisitions of less profitable downstream assets in Europe are justified for reasons of extended (foreign) policy reach through energy market control.                                                         | 8   | -0.27   | 27 | 0     | 21 | 1.52  | 4  |
| 9   | Retaining sufficient refining capacity in Europe is a key factor for the region's energy security.                                                                                                              | 9   | 2.18    | 1  | 0.60  | 13 | 0     | 19 |
| 10  | The Compulsory Stock Obligation (CSO) represents a cost for the industry, as it does not allow it to run down its stocks to the lowest level consistent with its operational requirements.                      | 10  | 0.45    | 12 | -1.34 | 39 | -0.27 | 24 |
| 11  | The substantial surplus of refining capacity in Europe can only lead to divestments of refining assets.                                                                                                         | 11  | 2.00    | 2  | 1.51  | 4  | 1.61  | 3  |

|    |                                                                                                                                                                                                                                       |    |       |    |       |    |       |    |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-------|----|-------|----|-------|----|
| 12 | Political pressure by European governments and labor unions on companies, is an important barrier for divestments of their uneconomic or poorly performing assets in Europe.                                                          | 12 | -0.11 | 21 | 0.34  | 17 | -0.18 | 22 |
| 13 | The growing competition European refiners face from their US counterparts worldwide, works mostly as an incentive for upgrading and expansion investments in European refineries.                                                     | 13 | 0.38  | 13 | -1.18 | 38 | -1.43 | 39 |
| 14 | A major reason for exiting the refining business in Europe is the strong labor laws and high wages.                                                                                                                                   | 14 | 0.38  | 14 | -0.16 | 23 | -0.72 | 35 |
| 15 | Most European refineries are configured to produce gasoline, however the European market demands more middle distillates, which is a major driver for upgrading investments in refineries.                                            | 15 | 1.42  | 6  | 0.47  | 15 | 2.24  | 1  |
| 16 | A major reason for acquiring storage facilities or converting refineries to storage in Europe, is compliance with compulsory stock obligations.                                                                                       | 16 | -1.84 | 42 | -0.58 | 30 | -0.54 | 28 |
| 17 | Acquisitions of refineries in Europe, is a good way to secure downstream outlets for your crude oil production and have a more efficient planning of output over time.                                                                | 17 | -0.40 | 30 | -0.16 | 22 | 1.08  | 7  |
| 18 | European refiners should invest more in chemical operations, as they will be able to offer a broader slate of products which can cushion against market-demand swings for fuel products.                                              | 18 | 1.29  | 7  | 0.47  | 14 | 0.27  | 14 |
| 19 | The current oversupply in the market will end, as smaller refineries close, therefore acquisitions of refineries in Europe can be justified.                                                                                          | 19 | -0.17 | 23 | -1.43 | 40 | -0.62 | 29 |
| 20 | The higher volatility and lower returns from investments downstream, than the ones from investments upstream (crude oil production), are a major driver for divestments of downstream assets in Europe.                               | 20 | 0.85  | 9  | 1.46  | 5  | 0.09  | 18 |
| 21 | Acquisition of midstream fixed logistic assets leads to better and faster exploitation of arbitrage opportunities.                                                                                                                    | 21 | -0.30 | 28 | 1.65  | 3  | -0.45 | 26 |
| 22 | A major reason for acquiring refineries and/or storage facilities in Europe, is the region's strategic location which offers global connectivity and increased trading potential.                                                     | 22 | -0.53 | 31 | -0.44 | 28 | 0.81  | 11 |
| 23 | The declining North Sea production and Urals availability, combined with increased future availability of other crude blends, is a good reason to invest in changing the European refineries configuration.                           | 23 | -0.21 | 25 | 0.02  | 20 | 0.54  | 12 |
| 24 | Local opposition is a major barrier for expanding or upgrading refining facilities in Europe.                                                                                                                                         | 24 | -0.11 | 20 | -1.13 | 37 | -2.24 | 42 |
| 25 | European refineries cannot compete with the new refineries in Asia and Middle East, as the latter are of high complexity and scale, and this works mostly as a driver for upgrading and expansion investments in European refineries. | 25 | 1.72  | 3  | -0.85 | 33 | -0.18 | 21 |
| 26 | Weak corporate balance sheets and the difficulty to access credit is a major barrier for investments in the European refining sector.                                                                                                 | 26 | 0.16  | 16 | -0.73 | 32 | 1.70  | 2  |
| 27 | A major driver for acquiring refineries in Europe is that you can gain a foothold in the region, without having to invest huge capital as many refineries are for sale at favorable prices.                                           | 27 | 0.64  | 10 | 1.09  | 7  | 0.44  | 13 |
| 28 | A major reason for divesting downstream assets is to boost the stock price and/or increase dividend payments to shareholders.                                                                                                         | 28 | -0.16 | 22 | 0.84  | 9  | -0.81 | 38 |

|           |                                                                                                                                                                                                                   |    |       |    |       |    |       |    |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-------|----|-------|----|-------|----|
| <b>29</b> | A major reason for acquiring European refineries and converting them to storage facilities for trading purposes, is that an established site simplifies compliance for environmental regulations.                 | 29 | -1.12 | 35 | 0.71  | 10 | -0.45 | 27 |
| <b>30</b> | Investments in the European refining sector are important for job creation purposes.                                                                                                                              | 30 | 0.18  | 15 | -0.31 | 25 | 0.18  | 16 |
| <b>31</b> | A major reason for converting unprofitable European refineries to terminals is mitigation of potential closure costs (including environmental, demolition, employee compensation and legal costs).                | 31 | 1.53  | 5  | 1.29  | 6  | 1.52  | 5  |
| <b>32</b> | A major reason for converting unprofitable European refineries to terminals is reduction of the plants' costs and release of working capital.                                                                     | 32 | -1.35 | 39 | 0.63  | 12 | 0.98  | 10 |
| <b>33</b> | The ownership of midstream physical assets in Europe and the creation of end-to-end supply chains open opportunities to gain access to exclusive and unpublished market information.                              | 33 | -0.19 | 24 | -0.18 | 24 | -0.80 | 36 |
| <b>34</b> | The increasing activity from independent retailers/distributors and hypermarkets, is a major reason for acquiring storage facilities or converting refining facilities to storage in Europe.                      | 34 | -0.64 | 33 | -0.63 | 31 | -0.27 | 23 |
| <b>35</b> | The mature European downstream market makes attractive the option to divest downstream assets in Europe and refocus on a strong downstream presence in other growth markets.                                      | 35 | 1.58  | 4  | 0.16  | 18 | 1.07  | 8  |
| <b>36</b> | An important reason for investing in the European downstream sector is risk and overheads spreading, as well as hedging against currency fluctuations.                                                            | 36 | -1.21 | 36 | -1.07 | 35 | -0.72 | 34 |
| <b>37</b> | The JVs of oil companies in the refining sector of non-European countries, help them shut refinery capacity in Europe and supply their wholesale and retail European networks with products from these countries. | 37 | -0.22 | 26 | -0.58 | 29 | -0.72 | 34 |
| <b>38</b> | Asset light strategies are preferred in Western Europe, due to the region's liquidity in petroleum products, good infrastructure, low refining margins and inadequate raw materials base.                         | 38 | -0.05 | 19 | 1.03  | 8  | -0.09 | 20 |
| <b>39</b> | The emergence of numerous traders, who have facilitated a liquid and competitive market for crude oil and refined products, makes downstream vertical disintegration attractive for oil companies.                | 39 | -0.03 | 18 | 0.65  | 11 | 0.18  | 17 |
| <b>40</b> | The higher freight costs for moving refined products to Europe from outside the region, than the costs for moving crude oil, is a major reason for investments in refineries located in Europe.                   | 40 | -1.23 | 38 | -0.33 | 26 | -0.36 | 25 |
| <b>41</b> | Asset-heavy strategies are becoming attractive because of the rise of financing and transaction costs due to regulatory changes in the banking and derivatives-trading environment.                               | 41 | -1.36 | 40 | -0.86 | 34 | -1.61 | 41 |
| <b>42</b> | A major reason for acquiring assets in the European downstream oil sector is for accessing new skills and capabilities in specific businesses within the oil value chain, for example oil products marketing.     | 42 | -1.04 | 34 | -0.37 | 27 | -0.72 | 34 |

This table allows for a direct comparison of how a particular item was ranked by each of the study factors (Watts & Stenner, 2012). It uses the scores of factor arrays and the z-scores (they will be presented in subsequent tables).

**Table 6: Correlations between factor scores.**

| Factor   | 1      | 2      | 3      |
|----------|--------|--------|--------|
| <b>1</b> | 1.0000 | 0.3659 | 0.2964 |
| <b>2</b> | 0.3659 | 1.0000 | 0.3906 |
| <b>3</b> | 0.2964 | 0.3906 | 1.0000 |

This table shows the extent to which each of the study factors inter-correlate. Reference to this table was made in the discussion paragraph of the report ([5.4](#)).

**Table 7: Z-scores for Factor 1.**

| No.       | Statement                                                                                                                                                                                                                             | No. | Z-Scores |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
| <b>9</b>  | Retaining sufficient refining capacity in Europe is a key factor for the region's energy security.                                                                                                                                    | 9   | 2.177    |
| <b>11</b> | The substantial surplus of refining capacity in Europe can only lead to divestments of refining assets.                                                                                                                               | 11  | 2.002    |
| <b>25</b> | European refineries cannot compete with the new refineries in Asia and Middle East, as the latter are of high complexity and scale, and this works mostly as a driver for upgrading and expansion investments in European refineries. | 25  | 1.721    |
| <b>35</b> | The mature European downstream market makes attractive the option to divest downstream assets in Europe and refocus on a strong downstream presence in other growth markets.                                                          | 35  | 1.576    |
| <b>31</b> | A major reason for converting unprofitable European refineries to terminals is mitigation of potential closure costs (including environmental, demolition, employee compensation and legal costs).                                    | 31  | 1.534    |
| <b>15</b> | Most European refineries are configured to produce gasoline, however the European market demands more middle distillates, which is a major driver for upgrading investments in refineries.                                            | 15  | 1.416    |
| <b>18</b> | European refiners should invest more in chemical operations, as they will be able to offer a broader slate of products which can cushion against market-demand swings for fuel products.                                              | 18  | 1.290    |
| <b>5</b>  | The high taxes on emissions in Europe is a major driver for divestments of refining assets.                                                                                                                                           | 5   | 0.891    |
| <b>20</b> | The higher volatility and lower returns from investments downstream, than the ones from investments upstream (crude oil production), are a major driver for divestments of downstream assets in Europe.                               | 20  | 0.852    |
| <b>27</b> | A major driver for acquiring refineries in Europe is that you can gain a foothold in the region, without having to invest huge capital as many refineries are for sale at favorable prices.                                           | 27  | 0.643    |
| <b>6</b>  | Changes in supply and demand patterns in Europe is a major reason for acquisitions of storage facilities or conversion of refining facilities to storage in the region, to help handle the new commodity flows.                       | 6   | 0.607    |
| <b>10</b> | The Compulsory Stock Obligation (CSO) represents a cost for the industry, as it does not allow it to run down its stocks to the lowest level consistent with its operational requirements.                                            | 10  | 0.450    |
| <b>13</b> | The growing competition European refiners face from their US counterparts worldwide, works mostly as an incentive for upgrading and expansion investments in European refineries.                                                     | 13  | 0.381    |

|    |                                                                                                                                                                                                                   |    |        |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|--------|
| 14 | A major reason for exiting the refining business in Europe is the strong labor laws and high wages.                                                                                                               | 14 | 0.378  |
| 30 | Investments in the European refining sector are important for job creation purposes.                                                                                                                              | 30 | 0.184  |
| 26 | Weak corporate balance sheets and the difficulty to access credit is a major barrier for investments in the European refining sector.                                                                             | 26 | 0.157  |
| 2  | The fall of demand for gasoline in the US market is a significant driver for divestments in the European downstream oil sector.                                                                                   | 2  | 0.000  |
| 39 | The emergence of numerous traders, who have facilitated a liquid and competitive market for crude oil and refined products, makes downstream vertical disintegration attractive for oil companies.                | 39 | -0.034 |
| 38 | Asset light strategies are preferred in Western Europe, due to the region's liquidity in petroleum products, good infrastructure, low refining margins and inadequate raw materials base.                         | 38 | -0.055 |
| 24 | Local opposition is a major barrier for expanding or upgrading refining facilities in Europe.                                                                                                                     | 24 | -0.106 |
| 12 | Political pressure by European governments and labor unions on companies, is an important barrier for divestments of their uneconomic or poorly performing assets in Europe.                                      | 12 | -0.112 |
| 28 | A major reason for divesting downstream assets is to boost the stock price and/or increase dividend payments to shareholders.                                                                                     | 28 | -0.157 |
| 19 | The current oversupply in the market will end, as smaller refineries close, therefore acquisitions of refineries in Europe can be justified.                                                                      | 19 | -0.169 |
| 33 | The ownership of midstream physical assets in Europe and the creation of end-to-end supply chains open opportunities to gain access to exclusive and unpublished market information.                              | 33 | -0.193 |
| 23 | The declining North Sea production and Urals availability, combined with increased future availability of other crude blends, is a good reason to invest in changing the European refineries configuration.       | 23 | -0.209 |
| 37 | The JVs of oil companies in the refining sector of non-European countries, help them shut refinery capacity in Europe and supply their wholesale and retail European networks with products from these countries. | 37 | -0.224 |
| 8  | Acquisitions of less profitable downstream assets in Europe are justified for reasons of extended (foreign) policy reach through energy market control.                                                           | 8  | -0.266 |
| 21 | Acquisition of midstream fixed logistic assets leads to better and faster exploitation of arbitrage opportunities.                                                                                                | 21 | -0.302 |
| 4  | Effective tax rates in Europe is an important driver for divestments in the European downstream oil sector.                                                                                                       | 4  | -0.360 |
| 17 | Acquisitions of refineries in Europe, is a good way to secure downstream outlets for your crude oil production and have a more efficient planning of output over time.                                            | 17 | -0.396 |
| 22 | A major reason for acquiring refineries and/or storage facilities in Europe, is the region's strategic location which offers global connectivity and increased trading potential.                                 | 22 | -0.532 |
| 1  | The growing competition European refiners face from their Russian counterparts in the European market, works mostly as an incentive for upgrading investments in European refineries.                             | 1  | -0.589 |
| 34 | The increasing activity from independent retailers/distributors and supermarkets, is a major reason for acquiring storage facilities or converting refining facilities to storage in Europe.                      | 34 | -0.643 |
| 42 | A major reason for acquiring assets in the European downstream oil sector is for accessing new skills and capabilities in specific businesses within the oil value chain, for example oil products marketing.     | 42 | -1.041 |
| 29 | A major reason for acquiring European refineries and converting them to storage facilities for trading purposes, is that an established site simplifies compliance for environmental regulations.                 | 29 | -1.123 |
| 36 | An important reason for investing in the European downstream sector is risk and overheads spreading, as well as hedging against currency fluctuations.                                                            | 36 | -1.211 |
| 3  | A major driver for acquiring downstream assets in Europe is because is a good way to help to serve the growing demand for fuels in Asian countries.                                                               | 3  | -1.229 |

|           |                                                                                                                                                                                                 |    |        |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|--------|
| <b>40</b> | The higher freight costs for moving refined products to Europe from outside the region, than the costs for moving crude oil, is a major reason for investments in refineries located in Europe. | 40 | -1.235 |
| <b>32</b> | A major reason for converting unprofitable European refineries to terminals is reduction of the plants' costs and release of working capital.                                                   | 32 | -1.347 |
| <b>41</b> | Asset-heavy strategies are becoming attractive because of the rise of financing and transaction costs due to regulatory changes in the banking and derivatives-trading environment.             | 41 | -1.362 |
| <b>7</b>  | The need to comply with the European environmental legislation (including biofuels mandates), works mostly as an incentive for upgrading investments in refineries.                             | 7  | -1.531 |
| <b>16</b> | A major reason for acquiring storage facilities or converting refineries to storage in Europe, is compliance with compulsory stock obligations.                                                 | 16 | -1.836 |

Table 8: Z-scores for Factor 2.

| No.       | Statement                                                                                                                                                                                                       | No. | Z-Scores |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
| <b>6</b>  | Changes in supply and demand patterns in Europe is a major reason for acquisitions of storage facilities or conversion of refining facilities to storage in the region, to help handle the new commodity flows. | 6   | 2.031    |
| <b>2</b>  | The fall of demand for gasoline in the US market is a significant driver for divestments in the European downstream oil sector.                                                                                 | 2   | 1.723    |
| <b>21</b> | Acquisition of midstream fixed logistic assets leads to better and faster exploitation of arbitrage opportunities.                                                                                              | 21  | 1.649    |
| <b>11</b> | The substantial surplus of refining capacity in Europe can only lead to divestments of refining assets.                                                                                                         | 11  | 1.514    |
| <b>20</b> | The higher volatility and lower returns from investments downstream, than the ones from investments upstream (crude oil production), are a major driver for divestments of downstream assets in Europe.         | 20  | 1.464    |
| <b>31</b> | A major reason for converting unprofitable European refineries to terminals is mitigation of potential closure costs (including environmental, demolition, employee compensation and legal costs).              | 31  | 1.292    |
| <b>27</b> | A major driver for acquiring refineries in Europe is that you can gain a foothold in the region, without having to invest huge capital as many refineries are for sale at favorable prices.                     | 27  | 1.095    |
| <b>38</b> | Asset light strategies are preferred in Western Europe, due to the region's liquidity in petroleum products, good infrastructure, low refining margins and inadequate raw materials base.                       | 38  | 1.034    |
| <b>28</b> | A major reason for divesting downstream assets is to boost the stock price and/or increase dividend payments to shareholders.                                                                                   | 28  | 0.836    |
| <b>29</b> | A major reason for acquiring European refineries and converting them to storage facilities for trading purposes, is that an established site simplifies compliance for environmental regulations.               | 29  | 0.714    |
| <b>39</b> | The emergence of numerous traders, who have facilitated a liquid and competitive market for crude oil and refined products, makes downstream vertical disintegration attractive for oil companies.              | 39  | 0.653    |
| <b>32</b> | A major reason for converting unprofitable European refineries to terminals is reduction of the plants' costs and release of working capital.                                                                   | 32  | 0.627    |
| <b>9</b>  | Retaining sufficient refining capacity in Europe is a key factor for the region's energy security.                                                                                                              | 9   | 0.603    |
| <b>18</b> | European refiners should invest more in chemical operations, as they will be able to offer a broader slate of products which can cushion against market-demand swings for fuel products.                        | 18  | 0.468    |
| <b>15</b> | Most European refineries are configured to produce gasoline, however the European market demands more middle distillates, which is a major driver for upgrading investments in refineries.                      | 15  | 0.467    |
| <b>7</b>  | The need to comply with the European environmental legislation (including biofuels mandates), works mostly as an incentive for upgrading investments in refineries.                                             | 7   | 0.345    |

|    |                                                                                                                                                                                                                                       |    |        |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|--------|
| 12 | Political pressure by European governments and labor unions on companies, is an important barrier for divestments of their uneconomic or poorly performing assets in Europe.                                                          | 12 | 0.345  |
| 35 | The mature European downstream market makes attractive the option to divest downstream assets in Europe and refocus on a strong downstream presence in other growth markets.                                                          | 35 | 0.161  |
| 5  | The high taxes on emissions in Europe is a major driver for divestments of refining assets.                                                                                                                                           | 5  | 0.122  |
| 23 | The declining North Sea production and Urals availability, combined with increased future availability of other crude blends, is a good reason to invest in changing the European refineries configuration.                           | 23 | 0.025  |
| 8  | Acquisitions of less profitable downstream assets in Europe are justified for reasons of extended (foreign) policy reach through energy market control.                                                                               | 8  | 0.000  |
| 17 | Acquisitions of refineries in Europe, is a good way to secure downstream outlets for your crude oil production and have a more efficient planning of output over time.                                                                | 17 | -0.161 |
| 14 | A major reason for exiting the refining business in Europe is the strong labor laws and high wages.                                                                                                                                   | 14 | -0.161 |
| 33 | The ownership of midstream physical assets in Europe and the creation of end-to-end supply chains open opportunities to gain access to exclusive and unpublished market information.                                                  | 33 | -0.184 |
| 30 | Investments in the European refining sector are important for job creation purposes.                                                                                                                                                  | 30 | -0.306 |
| 40 | The higher freight costs for moving refined products to Europe from outside the region, than the costs for moving crude oil, is a major reason for investments in refineries located in Europe.                                       | 40 | -0.332 |
| 42 | A major reason for acquiring assets in the European downstream oil sector is for accessing new skills and capabilities in specific businesses within the oil value chain, for example oil products marketing.                         | 42 | -0.368 |
| 22 | A major reason for acquiring refineries and/or storage facilities in Europe, is the region's strategic location which offers global connectivity and increased trading potential.                                                     | 22 | -0.444 |
| 37 | The JVs of oil companies in the refining sector of non-European countries, help them shut refinery capacity in Europe and supply their wholesale and retail European networks with products from these countries.                     | 37 | -0.578 |
| 16 | A major reason for acquiring storage facilities or converting refineries to storage in Europe, is compliance with compulsory stock obligations.                                                                                       | 16 | -0.580 |
| 34 | The increasing activity from independent retailers/distributors and supermarkets, is a major reason for acquiring storage facilities or converting refining facilities to storage in Europe.                                          | 34 | -0.628 |
| 26 | Weak corporate balance sheets and the difficulty to access credit is a major barrier for investments in the European refining sector.                                                                                                 | 26 | -0.727 |
| 25 | European refineries cannot compete with the new refineries in Asia and Middle East, as the latter are of high complexity and scale, and this works mostly as a driver for upgrading and expansion investments in European refineries. | 25 | -0.849 |
| 41 | Asset-heavy strategies are becoming attractive because of the rise of financing and transaction costs due to regulatory changes in the banking and derivatives-trading environment.                                                   | 41 | -0.862 |
| 36 | An important reason for investing in the European downstream sector is risk and overheads spreading, as well as hedging against currency fluctuations.                                                                                | 36 | -1.070 |
| 4  | Effective tax rates in Europe is an important driver for divestments in the European downstream oil sector.                                                                                                                           | 4  | -1.083 |
| 24 | Local opposition is a major barrier for expanding or upgrading refining facilities in Europe.                                                                                                                                         | 24 | -1.132 |
| 13 | The growing competition European refiners face from their US counterparts worldwide, works mostly as an incentive for upgrading and expansion investments in European refineries.                                                     | 13 | -1.182 |
| 10 | The Compulsory Stock Obligation (CSO) represents a cost for the industry, as it does not allow it to run down its stocks to the lowest level consistent with its operational requirements.                                            | 10 | -1.341 |

|    |                                                                                                                                                                                       |    |        |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|--------|
| 19 | The current oversupply in the market will end, as smaller refineries close, therefore acquisitions of refineries in Europe can be justified.                                          | 19 | -1.427 |
| 1  | The growing competition European refiners face from their Russian counterparts in the European market, works mostly as an incentive for upgrading investments in European refineries. | 1  | -1.600 |
| 3  | A major driver for acquiring downstream assets in Europe is because is a good way to help to serve the growing demand for fuels in Asian countries.                                   | 3  | -2.154 |

Table 9: Z-scores for Factor 3.

| No. | Statement                                                                                                                                                                                                   | No. | Z-Scores |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|
| 15  | Most European refineries are configured to produce gasoline, however the European market demands more middle distillates, which is a major driver for upgrading investments in refineries.                  | 15  | 2.236    |
| 26  | Weak corporate balance sheets and the difficulty to access credit is a major barrier for investments in the European refining sector.                                                                       | 26  | 1.698    |
| 11  | The substantial surplus of refining capacity in Europe can only lead to divestments of refining assets.                                                                                                     | 11  | 1.611    |
| 8   | Acquisitions of less profitable downstream assets in Europe are justified for reasons of extended (foreign) policy reach through energy market control.                                                     | 8   | 1.523    |
| 31  | A major reason for converting unprofitable European refineries to terminals is mitigation of potential closure costs (including environmental, demolition, employee compensation and legal costs).          | 31  | 1.52     |
| 2   | The fall of demand for gasoline in the US market is a significant driver for divestments in the European downstream oil sector.                                                                             | 2   | 1.432    |
| 17  | Acquisitions of refineries in Europe, is a good way to secure downstream outlets for your crude oil production and have a more efficient planning of output over time.                                      | 17  | 1.075    |
| 35  | The mature European downstream market makes attractive the option to divest downstream assets in Europe and refocus on a strong downstream presence in other growth markets.                                | 35  | 1.073    |
| 7   | The need to comply with the European environmental legislation (including biofuels mandates), works mostly as an incentive for upgrading investments in refineries.                                         | 7   | 0.985    |
| 32  | A major reason for converting unprofitable European refineries to terminals is reduction of the plants' costs and release of working capital.                                                               | 32  | 0.982    |
| 22  | A major reason for acquiring refineries and/or storage facilities in Europe, is the region's strategic location which offers global connectivity and increased trading potential.                           | 22  | 0.807    |
| 23  | The declining North Sea production and Urals availability, combined with increased future availability of other crude blends, is a good reason to invest in changing the European refineries configuration. | 23  | 0.535    |
| 27  | A major driver for acquiring refineries in Europe is that you can gain a foothold in the region, without having to invest huge capital as many refineries are for sale at favorable prices.                 | 27  | 0.445    |
| 18  | European refiners should invest more in chemical operations, as they will be able to offer a broader slate of products which can cushion against market-demand swings for fuel products.                    | 18  | 0.269    |
| 1   | The growing competition European refiners face from their Russian counterparts in the European market, works mostly as an incentive for upgrading investments in European refineries.                       | 1   | 0.181    |
| 30  | Investments in the European refining sector are important for job creation purposes.                                                                                                                        | 30  | 0.181    |
| 39  | The emergence of numerous traders, who have facilitated a liquid and competitive market for crude oil and refined products, makes downstream vertical disintegration attractive for oil companies.          | 39  | 0.178    |
| 20  | The higher volatility and lower returns from investments downstream, than the ones from investments upstream (crude oil production), are a major driver for divestments of downstream assets in Europe.     | 20  | 0.09     |

|    |                                                                                                                                                                                                                                       |    |        |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|--------|
| 9  | Retaining sufficient refining capacity in Europe is a key factor for the region's energy security.                                                                                                                                    | 9  | 0      |
| 38 | Asset light strategies are preferred in Western Europe, due to the region's liquidity in petroleum products, good infrastructure, low refining margins and inadequate raw materials base.                                             | 38 | -0.09  |
| 25 | European refineries cannot compete with the new refineries in Asia and Middle East, as the latter are of high complexity and scale, and this works mostly as a driver for upgrading and expansion investments in European refineries. | 25 | -0.176 |
| 12 | Political pressure by European governments and labor unions on companies, is an important barrier for divestments of their uneconomic or poorly performing assets in Europe.                                                          | 12 | -0.181 |
| 34 | The increasing activity from independent retailers/distributors and supermarkets, is a major reason for acquiring storage facilities or converting refining facilities to storage in Europe.                                          | 34 | -0.266 |
| 10 | The Compulsory Stock Obligation (CSO) represents a cost for the industry, as it does not allow it to run down its stocks to the lowest level consistent with its operational requirements.                                            | 10 | -0.269 |
| 40 | The higher freight costs for moving refined products to Europe from outside the region, than the costs for moving crude oil, is a major reason for investments in refineries located in Europe.                                       | 40 | -0.357 |
| 21 | Acquisition of midstream fixed logistic assets leads to better and faster exploitation of arbitrage opportunities.                                                                                                                    | 21 | -0.447 |
| 29 | A major reason for acquiring European refineries and converting them to storage facilities for trading purposes, is that an established site simplifies compliance for environmental regulations.                                     | 29 | -0.45  |
| 16 | A major reason for acquiring storage facilities or converting refineries to storage in Europe, is compliance with compulsory stock obligations.                                                                                       | 16 | -0.535 |
| 19 | The current oversupply in the market will end, as smaller refineries close, therefore acquisitions of refineries in Europe can be justified.                                                                                          | 19 | -0.623 |
| 4  | Effective tax rates in Europe is an important driver for divestments in the European downstream oil sector.                                                                                                                           | 4  | -0.628 |
| 6  | Changes in supply and demand patterns in Europe is a major reason for acquisitions of storage facilities or conversion of refining facilities to storage in the region, to help handle the new commodity flows.                       | 6  | -0.713 |
| 36 | An important reason for investing in the European downstream sector is risk and overheads spreading, as well as hedging against currency fluctuations.                                                                                | 36 | -0.716 |
| 37 | The JVs of oil companies in the refining sector of non-European countries, help them shut refinery capacity in Europe and supply their wholesale and retail European networks with products from these countries.                     | 37 | -0.716 |
| 42 | A major reason for acquiring assets in the European downstream oil sector is for accessing new skills and capabilities in specific businesses within the oil value chain, for example oil products marketing.                         | 42 | -0.716 |
| 14 | A major reason for exiting the refining business in Europe is the strong labor laws and high wages.                                                                                                                                   | 14 | -0.719 |
| 33 | The ownership of midstream physical assets in Europe and the creation of end-to-end supply chains open opportunities to gain access to exclusive and unpublished market information.                                                  | 33 | -0.804 |
| 3  | A major driver for acquiring downstream assets in Europe is because is a good way to help to serve the growing demand for fuels in Asian countries.                                                                                   | 3  | -0.807 |
| 28 | A major reason for divesting downstream assets is to boost the stock price and/or increase dividend payments to shareholders.                                                                                                         | 28 | -0.809 |
| 13 | The growing competition European refiners face from their US counterparts worldwide, works mostly as an incentive for upgrading and expansion investments in European refineries.                                                     | 13 | -1.432 |
| 5  | The high taxes on emissions in Europe is a major driver for divestments of refining assets.                                                                                                                                           | 5  | -1.52  |
| 41 | Asset-heavy strategies are becoming attractive because of the rise of financing and transaction costs due to regulatory changes in the banking and derivatives-trading environment.                                                   | 41 | -1.611 |

|    |                                                                                               |    |        |
|----|-----------------------------------------------------------------------------------------------|----|--------|
| 24 | Local opposition is a major barrier for expanding or upgrading refining facilities in Europe. | 24 | -2.236 |
|----|-----------------------------------------------------------------------------------------------|----|--------|

Table 10: Descending array of differences between Factors 1 and 2.

| No. | Statement                                                                                                                                                                                                                             | No. | Factor 1 | Factor 2 | Difference |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|----------|------------|
| 25  | European refineries cannot compete with the new refineries in Asia and Middle East, as the latter are of high complexity and scale, and this works mostly as a driver for upgrading and expansion investments in European refineries. | 25  | 1.721    | -0.849   | 2.570      |
| 10  | The Compulsory Stock Obligation (CSO) represents a cost for the industry, as it does not allow it to run down its stocks to the lowest level consistent with its operational requirements.                                            | 10  | 0.450    | -1.341   | 1.791      |
| 9   | Retaining sufficient refining capacity in Europe is a key factor for the region's energy security.                                                                                                                                    | 9   | 2.177    | 0.603    | 1.574      |
| 13  | The growing competition European refiners face from their US counterparts worldwide, works mostly as an incentive for upgrading and expansion investments in European refineries.                                                     | 13  | 0.381    | -1.182   | 1.563      |
| 35  | The mature European downstream market makes attractive the option to divest downstream assets in Europe and refocus on a strong downstream presence in other growth markets.                                                          | 35  | 1.576    | 0.161    | 1.415      |
| 19  | The current oversupply in the market will end, as smaller refineries close, therefore acquisitions of refineries in Europe can be justified.                                                                                          | 19  | -0.169   | -1.427   | 1.258      |
| 24  | Local opposition is a major barrier for expanding or upgrading refining facilities in Europe.                                                                                                                                         | 24  | -0.106   | -1.132   | 1.026      |
| 1   | The growing competition European refiners face from their Russian counterparts in the European market, works mostly as an incentive for upgrading investments in European refineries.                                                 | 1   | -0.589   | -1.600   | 1.011      |
| 15  | Most European refineries are configured to produce gasoline, however the European market demands more middle distillates, which is a major driver for upgrading investments in refineries.                                            | 15  | 1.416    | 0.467    | 0.949      |
| 3   | A major driver for acquiring downstream assets in Europe is because is a good way to help to serve the growing demand for fuels in Asian countries.                                                                                   | 3   | -1.229   | -2.154   | 0.925      |
| 26  | Weak corporate balance sheets and the difficulty to access credit is a major barrier for investments in the European refining sector.                                                                                                 | 26  | 0.157    | -0.727   | 0.883      |
| 18  | European refiners should invest more in chemical operations, as they will be able to offer a broader slate of products which can cushion against market-demand swings for fuel products.                                              | 18  | 1.290    | 0.468    | 0.821      |
| 5   | The high taxes on emissions in Europe is a major driver for divestments of refining assets.                                                                                                                                           | 5   | 0.891    | 0.122    | 0.768      |
| 4   | Effective tax rates in Europe is an important driver for divestments in the European downstream oil sector.                                                                                                                           | 4   | -0.360   | -1.083   | 0.724      |
| 14  | A major reason for exiting the refining business in Europe is the strong labor laws and high wages.                                                                                                                                   | 14  | 0.378    | -0.161   | 0.539      |
| 30  | Investments in the European refining sector are important for job creation purposes.                                                                                                                                                  | 30  | 0.184    | -0.306   | 0.491      |
| 11  | The substantial surplus of refining capacity in Europe can only lead to divestments of refining assets.                                                                                                                               | 11  | 2.002    | 1.514    | 0.488      |
| 37  | The JVs of oil companies in the refining sector of non-European countries, help them shut refinery capacity in Europe and supply their wholesale and retail European networks with products from these countries.                     | 37  | -0.224   | -0.578   | 0.354      |
| 31  | A major reason for converting unprofitable European refineries to terminals is mitigation of potential closure costs (including environmental, demolition, employee compensation and legal costs).                                    | 31  | 1.534    | 1.292    | 0.242      |
| 33  | The ownership of midstream physical assets in Europe and the creation of end-to-end supply chains open opportunities to gain access to exclusive and unpublished market information.                                                  | 33  | -0.193   | -0.184   | -0.008     |

|    |                                                                                                                                                                                                                 |    |        |        |        |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|--------|--------|--------|
| 34 | The increasing activity from independent retailers/distributors and hypermarkets, is a major reason for acquiring storage facilities or converting refining facilities to storage in Europe.                    | 34 | -0.643 | -0.628 | -0.015 |
| 22 | A major reason for acquiring refineries and/or storage facilities in Europe, is the region's strategic location which offers global connectivity and increased trading potential.                               | 22 | -0.532 | -0.444 | -0.088 |
| 36 | An important reason for investing in the European downstream sector is risk and overheads spreading, as well as hedging against currency fluctuations.                                                          | 36 | -1.211 | -1.070 | -0.140 |
| 23 | The declining North Sea production and Urals availability, combined with increased future availability of other crude blends, is a good reason to invest in changing the European refineries configuration.     | 23 | -0.209 | 0.025  | -0.233 |
| 17 | Acquisitions of refineries in Europe, is a good way to secure downstream outlets for your crude oil production and have a more efficient planning of output over time.                                          | 17 | -0.396 | -0.161 | -0.235 |
| 8  | Acquisitions of less profitable downstream assets in Europe are justified for reasons of extended (foreign) policy reach through energy market control.                                                         | 8  | -0.266 | 0.000  | -0.266 |
| 27 | A major driver for acquiring refineries in Europe is that you can gain a foothold in the region, without having to invest huge capital as many refineries are for sale at favorable prices.                     | 27 | 0.643  | 1.095  | -0.452 |
| 12 | Political pressure by European governments and labor unions on companies, is an important barrier for divestments of their uneconomic or poorly performing assets in Europe.                                    | 12 | -0.112 | 0.345  | -0.457 |
| 41 | Asset-heavy strategies are becoming attractive because of the rise of financing and transaction costs due to regulatory changes in the banking and derivatives-trading environment.                             | 41 | -1.362 | -0.862 | -0.500 |
| 20 | The higher volatility and lower returns from investments downstream, than the ones from investments upstream (crude oil production), are a major driver for divestments of downstream assets in Europe.         | 20 | 0.852  | 1.464  | -0.612 |
| 42 | A major reason for acquiring assets in the European downstream oil sector is for accessing new skills and capabilities in specific businesses within the oil value chain, for example oil products marketing.   | 42 | -1.041 | -0.368 | -0.674 |
| 39 | The emergence of numerous traders, who have facilitated a liquid and competitive market for crude oil and refined products, makes downstream vertical disintegration attractive for oil companies.              | 39 | -0.034 | 0.653  | -0.686 |
| 40 | The higher freight costs for moving refined products to Europe from outside the region, than the costs for moving crude oil, is a major reason for investments in refineries located in Europe.                 | 40 | -1.235 | -0.332 | -0.903 |
| 28 | A major reason for divesting downstream assets is to boost the stock price and/or increase dividend payments to shareholders.                                                                                   | 28 | -0.157 | 0.836  | -0.993 |
| 38 | Asset light strategies are preferred in Western Europe, due to the region's liquidity in petroleum products, good infrastructure, low refining margins and inadequate raw materials base.                       | 38 | -0.055 | 1.034  | -1.088 |
| 16 | A major reason for acquiring storage facilities or converting refineries to storage in Europe, is compliance with compulsory stock obligations.                                                                 | 16 | -1.836 | -0.580 | -1.256 |
| 6  | Changes in supply and demand patterns in Europe is a major reason for acquisitions of storage facilities or conversion of refining facilities to storage in the region, to help handle the new commodity flows. | 6  | 0.607  | 2.031  | -1.424 |
| 2  | The fall of demand for gasoline in the US market is a significant driver for divestments in the European downstream oil sector.                                                                                 | 2  | 0.000  | 1.723  | -1.723 |
| 29 | A major reason for acquiring European refineries and converting them to storage facilities for trading purposes, is that an established site simplifies compliance for environmental regulations.               | 29 | -1.123 | 0.714  | -1.837 |
| 7  | The need to comply with the European environmental legislation (including biofuels mandates), works mostly as an incentive for upgrading investments in refineries.                                             | 7  | -1.531 | 0.345  | -1.876 |
| 21 | Acquisition of midstream fixed logistic assets leads to better and faster exploitation of arbitrage opportunities.                                                                                              | 21 | -0.302 | 1.649  | -1.951 |
| 32 | A major reason for converting unprofitable European refineries to terminals is reduction of the plants' costs and release of working capital.                                                                   | 32 | -1.347 | 0.627  | -1.973 |

Table 11: Descending array of differences between Factors 1 and 3.

| No. | Statement                                                                                                                                                                                                                             | No. | Factor 1 | Factor 3 | Difference |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|----------|------------|
| 5   | The high taxes on emissions in Europe is a major driver for divestments of refining assets.                                                                                                                                           | 5   | 0.891    | -1.520   | 2.411      |
| 9   | Retaining sufficient refining capacity in Europe is a key factor for the region's energy security.                                                                                                                                    | 9   | 2.177    | 0.000    | 2.177      |
| 24  | Local opposition is a major barrier for expanding or upgrading refining facilities in Europe.                                                                                                                                         | 24  | -0.106   | -2.236   | 2.130      |
| 25  | European refineries cannot compete with the new refineries in Asia and Middle East, as the latter are of high complexity and scale, and this works mostly as a driver for upgrading and expansion investments in European refineries. | 25  | 1.721    | -0.176   | 1.897      |
| 13  | The growing competition European refiners face from their US counterparts worldwide, works mostly as an incentive for upgrading and expansion investments in European refineries.                                                     | 13  | 0.381    | -1.432   | 1.813      |
| 6   | Changes in supply and demand patterns in Europe is a major reason for acquisitions of storage facilities or conversion of refining facilities to storage in the region, to help handle the new commodity flows.                       | 6   | 0.607    | -0.713   | 1.320      |
| 14  | A major reason for exiting the refining business in Europe is the strong labor laws and high wages.                                                                                                                                   | 14  | 0.378    | -0.719   | 1.097      |
| 18  | European refiners should invest more in chemical operations, as they will be able to offer a broader slate of products which can cushion against market-demand swings for fuel products.                                              | 18  | 1.290    | 0.269    | 1.021      |
| 20  | The higher volatility and lower returns from investments downstream, than the ones from investments upstream (crude oil production), are a major driver for divestments of downstream assets in Europe.                               | 20  | 0.852    | 0.090    | 0.761      |
| 10  | The Compulsory Stock Obligation (CSO) represents a cost for the industry, as it does not allow it to run down its stocks to the lowest level consistent with its operational requirements.                                            | 10  | 0.450    | -0.269   | 0.719      |
| 28  | A major reason for divesting downstream assets is to boost the stock price and/or increase dividend payments to shareholders.                                                                                                         | 28  | -0.157   | -0.809   | 0.652      |
| 33  | The ownership of midstream physical assets in Europe and the creation of end-to-end supply chains open opportunities to gain access to exclusive and unpublished market information.                                                  | 33  | -0.193   | -0.804   | 0.611      |
| 35  | The mature European downstream market makes attractive the option to divest downstream assets in Europe and refocus on a strong downstream presence in other growth markets.                                                          | 35  | 1.576    | 1.073    | 0.503      |
| 37  | The JVs of oil companies in the refining sector of non-European countries, help them shut refinery capacity in Europe and supply their wholesale and retail European networks with products from these countries.                     | 37  | -0.224   | -0.716   | 0.493      |
| 19  | The current oversupply in the market will end, as smaller refineries close, therefore acquisitions of refineries in Europe can be justified.                                                                                          | 19  | -0.169   | -0.623   | 0.454      |
| 11  | The substantial surplus of refining capacity in Europe can only lead to divestments of refining assets.                                                                                                                               | 11  | 2.002    | 1.611    | 0.392      |
| 4   | Effective tax rates in Europe is an important driver for divestments in the European downstream oil sector.                                                                                                                           | 4   | -0.360   | -0.628   | 0.268      |
| 41  | Asset-heavy strategies are becoming attractive because of the rise of financing and transaction costs due to regulatory changes in the banking and derivatives-trading environment.                                                   | 41  | -1.362   | -1.611   | 0.249      |
| 27  | A major driver for acquiring refineries in Europe is that you can gain a foothold in the region, without having to invest huge capital as many refineries are for sale at favorable prices.                                           | 27  | 0.643    | 0.445    | 0.199      |
| 21  | Acquisition of midstream fixed logistic assets leads to better and faster exploitation of arbitrage opportunities.                                                                                                                    | 21  | -0.302   | -0.447   | 0.145      |
| 12  | Political pressure by European governments and labor unions on companies, is an important barrier for divestments of their uneconomic or poorly performing assets in Europe.                                                          | 12  | -0.112   | -0.181   | 0.069      |

|    |                                                                                                                                                                                                               |    |        |        |        |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|--------|--------|--------|
| 38 | Asset light strategies are preferred in Western Europe, due to the region's liquidity in petroleum products, good infrastructure, low refining margins and inadequate raw materials base.                     | 38 | -0.055 | -0.090 | 0.036  |
| 31 | A major reason for converting unprofitable European refineries to terminals is mitigation of potential closure costs (including environmental, demolition, employee compensation and legal costs).            | 31 | 1.534  | 1.520  | 0.014  |
| 30 | Investments in the European refining sector are important for job creation purposes.                                                                                                                          | 30 | 0.184  | 0.181  | 0.003  |
| 39 | The emergence of numerous traders, who have facilitated a liquid and competitive market for crude oil and refined products, makes downstream vertical disintegration attractive for oil companies.            | 39 | -0.034 | 0.178  | -0.212 |
| 42 | A major reason for acquiring assets in the European downstream oil sector is for accessing new skills and capabilities in specific businesses within the oil value chain, for example oil products marketing. | 42 | -1.041 | -0.716 | -0.325 |
| 34 | The increasing activity from independent retailers/distributors and hypermarkets, is a major reason for acquiring storage facilities or converting refining facilities to storage in Europe.                  | 34 | -0.643 | -0.266 | -0.377 |
| 3  | A major driver for acquiring downstream assets in Europe is because is a good way to help to serve the growing demand for fuels in Asian countries.                                                           | 3  | -1.229 | -0.807 | -0.422 |
| 36 | An important reason for investing in the European downstream sector is risk and overheads spreading, as well as hedging against currency fluctuations.                                                        | 36 | -1.211 | -0.716 | -0.495 |
| 29 | A major reason for acquiring European refineries and converting them to storage facilities for trading purposes, is that an established site simplifies compliance for environmental regulations.             | 29 | -1.123 | -0.450 | -0.673 |
| 23 | The declining North Sea production and Urals availability, combined with increased future availability of other crude blends, is a good reason to invest in changing the European refineries configuration.   | 23 | -0.209 | 0.535  | -0.744 |
| 1  | The growing competition European refiners face from their Russian counterparts in the European market, works mostly as an incentive for upgrading investments in European refineries.                         | 1  | -0.589 | 0.181  | -0.770 |
| 15 | Most European refineries are configured to produce gasoline, however the European market demands more middle distillates, which is a major driver for upgrading investments in refineries.                    | 15 | 1.416  | 2.236  | -0.820 |
| 40 | The higher freight costs for moving refined products to Europe from outside the region, than the costs for moving crude oil, is a major reason for investments in refineries located in Europe.               | 40 | -1.235 | -0.357 | -0.878 |
| 16 | A major reason for acquiring storage facilities or converting refineries to storage in Europe, is compliance with compulsory stock obligations.                                                               | 16 | -1.836 | -0.535 | -1.301 |
| 22 | A major reason for acquiring refineries and/or storage facilities in Europe, is the region's strategic location which offers global connectivity and increased trading potential.                             | 22 | -0.532 | 0.807  | -1.338 |
| 2  | The fall of demand for gasoline in the US market is a significant driver for divestments in the European downstream oil sector.                                                                               | 2  | 0.000  | 1.432  | -1.432 |
| 17 | Acquisitions of refineries in Europe, is a good way to secure downstream outlets for your crude oil production and have a more efficient planning of output over time.                                        | 17 | -0.396 | 1.075  | -1.471 |
| 26 | Weak corporate balance sheets and the difficulty to access credit is a major barrier for investments in the European refining sector.                                                                         | 26 | 0.157  | 1.698  | -1.542 |
| 8  | Acquisitions of less profitable downstream assets in Europe are justified for reasons of extended (foreign) policy reach through energy market control.                                                       | 8  | -0.266 | 1.523  | -1.788 |
| 32 | A major reason for converting unprofitable European refineries to terminals is reduction of the plants' costs and release of working capital.                                                                 | 32 | -1.347 | 0.982  | -2.329 |
| 7  | The need to comply with the European environmental legislation (including biofuels mandates), works mostly as an incentive for upgrading investments in refineries.                                           | 7  | -1.531 | 0.985  | -2.516 |

Table 12: Descending array of differences between Factors 2 and 3.

| No. | Statement                                                                                                                                                                                                         | No. | Factor 2 | Factor 3 | Difference |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------|----------|------------|
| 6   | Changes in supply and demand patterns in Europe is a major reason for acquisitions of storage facilities or conversion of refining facilities to storage in the region, to help handle the new commodity flows.   | 6   | 2.031    | -0.713   | 2.744      |
| 21  | Acquisition of midstream fixed logistic assets leads to better and faster exploitation of arbitrage opportunities.                                                                                                | 21  | 1.649    | -0.447   | 2.096      |
| 28  | A major reason for divesting downstream assets is to boost the stock price and/or increase dividend payments to shareholders.                                                                                     | 28  | 0.836    | -0.809   | 1.645      |
| 5   | The high taxes on emissions in Europe is a major driver for divestments of refining assets.                                                                                                                       | 5   | 0.122    | -1.520   | 1.643      |
| 20  | The higher volatility and lower returns from investments downstream, than the ones from investments upstream (crude oil production), are a major driver for divestments of downstream assets in Europe.           | 20  | 1.464    | 0.090    | 1.373      |
| 29  | A major reason for acquiring European refineries and converting them to storage facilities for trading purposes, is that an established site simplifies compliance for environmental regulations.                 | 29  | 0.714    | -0.450   | 1.164      |
| 38  | Asset light strategies are preferred in Western Europe, due to the region's liquidity in petroleum products, good infrastructure, low refining margins and inadequate raw materials base.                         | 38  | 1.034    | -0.090   | 1.124      |
| 24  | Local opposition is a major barrier for expanding or upgrading refining facilities in Europe.                                                                                                                     | 24  | -1.132   | -2.236   | 1.104      |
| 41  | Asset-heavy strategies are becoming attractive because of the rise of financing and transaction costs due to regulatory changes in the banking and derivatives-trading environment.                               | 41  | -0.862   | -1.611   | 0.749      |
| 27  | A major driver for acquiring refineries in Europe is that you can gain a foothold in the region, without having to invest huge capital as many refineries are for sale at favorable prices.                       | 27  | 1.095    | 0.445    | 0.650      |
| 33  | The ownership of midstream physical assets in Europe and the creation of end-to-end supply chains open opportunities to gain access to exclusive and unpublished market information.                              | 33  | -0.184   | -0.804   | 0.620      |
| 9   | Retaining sufficient refining capacity in Europe is a key factor for the region's energy security.                                                                                                                | 9   | 0.603    | 0.000    | 0.603      |
| 14  | A major reason for exiting the refining business in Europe is the strong labor laws and high wages.                                                                                                               | 14  | -0.161   | -0.719   | 0.558      |
| 12  | Political pressure by European governments and labor unions on companies, is an important barrier for divestments of their uneconomic or poorly performing assets in Europe.                                      | 12  | 0.345    | -0.181   | 0.526      |
| 39  | The emergence of numerous traders, who have facilitated a liquid and competitive market for crude oil and refined products, makes downstream vertical disintegration attractive for oil companies.                | 39  | 0.653    | 0.178    | 0.474      |
| 42  | A major reason for acquiring assets in the European downstream oil sector is for accessing new skills and capabilities in specific businesses within the oil value chain, for example oil products marketing.     | 42  | -0.368   | -0.716   | 0.348      |
| 2   | The fall of demand for gasoline in the US market is a significant driver for divestments in the European downstream oil sector.                                                                                   | 2   | 1.723    | 1.432    | 0.291      |
| 13  | The growing competition European refiners face from their US counterparts worldwide, works mostly as an incentive for upgrading and expansion investments in European refineries.                                 | 13  | -1.182   | -1.432   | 0.250      |
| 18  | European refiners should invest more in chemical operations, as they will be able to offer a broader slate of products which can cushion against market-demand swings for fuel products.                          | 18  | 0.468    | 0.269    | 0.199      |
| 37  | The JVs of oil companies in the refining sector of non-European countries, help them shut refinery capacity in Europe and supply their wholesale and retail European networks with products from these countries. | 37  | -0.578   | -0.716   | 0.138      |
| 40  | The higher freight costs for moving refined products to Europe from outside the region, than the costs for moving crude oil, is a major reason for investments in refineries located in Europe.                   | 40  | -0.332   | -0.357   | 0.025      |
| 16  | A major reason for acquiring storage facilities or converting refineries to storage in Europe, is compliance with compulsory stock obligations.                                                                   | 16  | -0.580   | -0.535   | -0.045     |

|    |                                                                                                                                                                                                                                       |    |        |        |        |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|--------|--------|--------|
| 11 | The substantial surplus of refining capacity in Europe can only lead to divestments of refining assets.                                                                                                                               | 11 | 1.514  | 1.611  | -0.096 |
| 31 | A major reason for converting unprofitable European refineries to terminals is mitigation of potential closure costs (including environmental, demolition, employee compensation and legal costs).                                    | 31 | 1.292  | 1.520  | -0.228 |
| 36 | An important reason for investing in the European downstream sector is risk and overheads spreading, as well as hedging against currency fluctuations.                                                                                | 36 | -1.070 | -0.716 | -0.354 |
| 32 | A major reason for converting unprofitable European refineries to terminals is reduction of the plants' costs and release of working capital.                                                                                         | 32 | 0.627  | 0.982  | -0.355 |
| 34 | The increasing activity from independent retailers/distributors and hypermarkets, is a major reason for acquiring storage facilities or converting refining facilities to storage in Europe.                                          | 34 | -0.628 | -0.266 | -0.362 |
| 4  | Effective tax rates in Europe is an important driver for divestments in the European downstream oil sector.                                                                                                                           | 4  | -1.083 | -0.628 | -0.455 |
| 30 | Investments in the European refining sector are important for job creation purposes.                                                                                                                                                  | 30 | -0.306 | 0.181  | -0.487 |
| 23 | The declining North Sea production and Urals availability, combined with increased future availability of other crude blends, is a good reason to invest in changing the European refineries configuration.                           | 23 | 0.025  | 0.535  | -0.511 |
| 7  | The need to comply with the European environmental legislation (including biofuels mandates), works mostly as an incentive for upgrading investments in refineries.                                                                   | 7  | 0.345  | 0.985  | -0.640 |
| 25 | European refineries cannot compete with the new refineries in Asia and Middle East, as the latter are of high complexity and scale, and this works mostly as a driver for upgrading and expansion investments in European refineries. | 25 | -0.849 | -0.176 | -0.673 |
| 19 | The current oversupply in the market will end, as smaller refineries close, therefore acquisitions of refineries in Europe can be justified.                                                                                          | 19 | -1.427 | -0.623 | -0.804 |
| 35 | The mature European downstream market makes attractive the option to divest downstream assets in Europe and refocus on a strong downstream presence in other growth markets.                                                          | 35 | 0.161  | 1.073  | -0.912 |
| 10 | The Compulsory Stock Obligation (CSO) represents a cost for the industry, as it does not allow it to run down its stocks to the lowest level consistent with its operational requirements.                                            | 10 | -1.341 | -0.269 | -1.072 |
| 17 | Acquisitions of refineries in Europe, is a good way to secure downstream outlets for your crude oil production and have a more efficient planning of output over time.                                                                | 17 | -0.161 | 1.075  | -1.236 |
| 22 | A major reason for acquiring refineries and/or storage facilities in Europe, is the region's strategic location which offers global connectivity and increased trading potential.                                                     | 22 | -0.444 | 0.807  | -1.250 |
| 3  | A major driver for acquiring downstream assets in Europe is because is a good way to help to serve the growing demand for fuels in Asian countries.                                                                                   | 3  | -2.154 | -0.807 | -1.347 |
| 8  | Acquisitions of less profitable downstream assets in Europe are justified for reasons of extended (foreign) policy reach through energy market control.                                                                               | 8  | 0.000  | 1.523  | -1.523 |
| 15 | Most European refineries are configured to produce gasoline, however the European market demands more middle distillates, which is a major driver for upgrading investments in refineries.                                            | 15 | 0.467  | 2.236  | -1.769 |
| 1  | The growing competition European refiners face from their Russian counterparts in the European market, works mostly as an incentive for upgrading investments in European refineries.                                                 | 1  | -1.600 | 0.181  | -1.781 |
| 26 | Weak corporate balance sheets and the difficulty to access credit is a major barrier for investments in the European refining sector.                                                                                                 | 26 | -0.727 | 1.698  | -2.425 |

As Watts & Stenner (2012, p. 209) mention “a descending array of differences table produced by the PQMethod exploits the z-scores as a means of showing you the biggest and smallest differences that hold between the items rankings of any particular pair of factors in your study”. These tables have been referred under paragraph 5.3 of the main report.

Table 13: Exact Factor scores (a la SPSS) in Z-score and T-score units.

| No. | Statement                                                                                                                                                                                                       | No. | Factors |    |       |    |       |    |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---------|----|-------|----|-------|----|
|     |                                                                                                                                                                                                                 |     | 1       |    | 2     |    | 3     |    |
| 1   | The growing competition European refiners face from their Russian counterparts in the European market, works mostly as an incentive for upgrading investments in European refineries.                           | 1   | -0.21   | 48 | -1.75 | 32 | 0.74  | 57 |
| 2   | The fall of demand for gasoline in the US market is a significant driver for divestments in the European downstream oil sector.                                                                                 | 2   | -0.16   | 48 | 1.63  | 66 | 0.77  | 58 |
| 3   | A major driver for acquiring downstream assets in Europe is because is a good way to help to serve the growing demand for fuels in Asian countries.                                                             | 3   | -1.05   | 39 | -1.90 | 31 | -0.44 | 46 |
| 4   | Effective tax rates in Europe is an important driver for divestments in the European downstream oil sector.                                                                                                     | 4   | -0.16   | 48 | -0.52 | 45 | -0.36 | 46 |
| 5   | The high taxes on emissions in Europe is a major driver for divestments of refining assets.                                                                                                                     | 5   | 1.85    | 68 | 0.54  | 55 | -1.77 | 32 |
| 6   | Changes in supply and demand patterns in Europe is a major reason for acquisitions of storage facilities or conversion of refining facilities to storage in the region, to help handle the new commodity flows. | 6   | 0.34    | 53 | 1.92  | 69 | -1.29 | 37 |
| 7   | The need to comply with the European environmental legislation (including biofuels mandates), works mostly as an incentive for upgrading investments in refineries.                                             | 7   | -1.65   | 34 | -0.2  | 48 | 1.49  | 65 |
| 8   | Acquisitions of less profitable downstream assets in Europe are justified for reasons of extended (foreign) policy reach through energy market control.                                                         | 8   | -0.64   | 44 | -0.79 | 42 | 1.29  | 63 |
| 9   | Retaining sufficient refining capacity in Europe is a key factor for the region's energy security.                                                                                                              | 9   | 1.95    | 69 | -0.07 | 49 | 0.30  | 53 |
| 10  | The Compulsory Stock Obligation (CSO) represents a cost for the industry, as it does not allow it to run down its stocks to the lowest level consistent with its operational requirements.                      | 10  | 0.62    | 56 | -0.73 | 43 | -0.61 | 44 |
| 11  | The substantial surplus of refining capacity in Europe can only lead to divestments of refining assets.                                                                                                         | 11  | 1.58    | 66 | 1.03  | 60 | 1.27  | 63 |
| 12  | Political pressure by European governments and labor unions on companies, is an important barrier for divestments of their uneconomic or poorly performing assets in Europe.                                    | 12  | -0.36   | 46 | 0.49  | 55 | -0.07 | 49 |
| 13  | The growing competition European refiners face from their US counterparts worldwide, works mostly as an incentive for upgrading and expansion investments in European refineries.                               | 13  | 0.18    | 52 | -1.58 | 34 | -0.79 | 42 |
| 14  | A major reason for exiting the refining business in Europe is the strong labor laws and high wages.                                                                                                             | 14  | 0.10    | 51 | 0.20  | 52 | -0.68 | 43 |
| 15  | Most European refineries are configured to produce gasoline, however the European market demands more middle distillates, which is a major driver for upgrading investments in refineries.                      | 15  | 1.23    | 62 | -0.36 | 46 | 2.39  | 74 |
| 16  | A major reason for acquiring storage facilities or converting refineries to storage in Europe, is compliance with compulsory stock obligations.                                                                 | 16  | -1.62   | 34 | -0.55 | 44 | -0.36 | 46 |
| 17  | Acquisitions of refineries in Europe, is a good way to secure downstream outlets for your crude oil production and have a more efficient planning of output over time.                                          | 17  | 0.34    | 53 | -0.19 | 48 | 0.97  | 60 |
| 18  | European refiners should invest more in chemical operations, as they will be able to offer a broader slate of products which can cushion against market-demand swings for fuel products.                        | 18  | 0.73    | 57 | -0.08 | 49 | 0.20  | 52 |
| 19  | The current oversupply in the market will end, as smaller refineries close, therefore acquisitions of refineries in Europe can be justified.                                                                    | 19  | 0.60    | 56 | -1.16 | 38 | -1.28 | 37 |

|    |                                                                                                                                                                                                                                       |    |       |    |       |    |       |    |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-------|----|-------|----|-------|----|
| 20 | The higher volatility and lower returns from investments downstream, than the ones from investments upstream (crude oil production), are a major driver for divestments of downstream assets in Europe.                               | 20 | 1.01  | 60 | 0.94  | 59 | 0.12  | 51 |
| 21 | Acquisition of midstream fixed logistic assets leads to better and faster exploitation of arbitrage opportunities.                                                                                                                    | 21 | -0.45 | 46 | 2.49  | 75 | -1.03 | 40 |
| 22 | A major reason for acquiring refineries and/or storage facilities in Europe, is the region's strategic location which offers global connectivity and increased trading potential.                                                     | 22 | 0.01  | 50 | -0.54 | 45 | 0.90  | 59 |
| 23 | The declining North Sea production and Urals availability, combined with increased future availability of other crude blends, is a good reason to invest in changing the European refineries configuration.                           | 23 | -0.32 | 47 | 0.19  | 52 | 0.75  | 57 |
| 24 | Local opposition is a major barrier for expanding or upgrading refining facilities in Europe.                                                                                                                                         | 24 | 0.87  | 59 | -0.68 | 43 | -2.37 | 26 |
| 25 | European refineries cannot compete with the new refineries in Asia and Middle East, as the latter are of high complexity and scale, and this works mostly as a driver for upgrading and expansion investments in European refineries. | 25 | 2.11  | 71 | -1.43 | 36 | -0.10 | 49 |
| 26 | Weak corporate balance sheets and the difficulty to access credit is a major barrier for investments in the European refining sector.                                                                                                 | 26 | -0.14 | 49 | -0.73 | 43 | 1.60  | 66 |
| 27 | A major driver for acquiring refineries in Europe is that you can gain a foothold in the region, without having to invest huge capital as many refineries are for sale at favorable prices.                                           | 27 | -0.04 | 50 | 0.50  | 55 | 0.63  | 56 |
| 28 | A major reason for divesting downstream assets is to boost the stock price and/or increase dividend payments to shareholders.                                                                                                         | 28 | -0.87 | 41 | 1.32  | 63 | -0.81 | 42 |
| 29 | A major reason for acquiring European refineries and converting them to storage facilities for trading purposes, is that an established site simplifies compliance for environmental regulations.                                     | 29 | -1.37 | 36 | 0.81  | 58 | 0.28  | 53 |
| 30 | Investments in the European refining sector are important for job creation purposes.                                                                                                                                                  | 30 | 0.41  | 54 | -0.32 | 47 | 0.30  | 53 |
| 31 | A major reason for converting unprofitable European refineries to terminals is mitigation of potential closure costs (including environmental, demolition, employee compensation and legal costs).                                    | 31 | 1.29  | 63 | 0.99  | 60 | 1.25  | 63 |
| 32 | A major reason for converting unprofitable European refineries to terminals is reduction of the plants' costs and release of working capital.                                                                                         | 32 | -1.59 | 34 | 0.96  | 60 | 0.95  | 59 |
| 33 | The ownership of midstream physical assets in Europe and the creation of end-to-end supply chains open opportunities to gain access to exclusive and unpublished market information.                                                  | 33 | -0.30 | 47 | -0.27 | 47 | -0.53 | 45 |
| 34 | The increasing activity from independent retailers/distributors and hypermarkets, is a major reason for acquiring storage facilities or converting refining facilities to storage in Europe.                                          | 34 | -0.62 | 44 | -0.68 | 43 | -0.41 | 46 |
| 35 | The mature European downstream market makes attractive the option to divest downstream assets in Europe and refocus on a strong downstream presence in other growth markets.                                                          | 35 | 1.61  | 66 | 0.34  | 53 | 0.15  | 51 |
| 36 | An important reason for investing in the European downstream sector is risk and overheads spreading, as well as hedging against currency fluctuations.                                                                                | 36 | -1.06 | 39 | -0.54 | 45 | -1.16 | 38 |
| 37 | The JVs of oil companies in the refining sector of non-European countries, help them shut refinery capacity in Europe and supply their wholesale and retail European networks with products from these countries.                     | 37 | -0.33 | 47 | -0.35 | 46 | -0.54 | 45 |
| 38 | Asset light strategies are preferred in Western Europe, due to the region's liquidity in petroleum products, good infrastructure, low refining margins and inadequate raw materials base.                                             | 38 | -0.86 | 41 | 1.52  | 65 | -0.12 | 49 |

|           |                                                                                                                                                                                                               |    |       |    |       |    |       |    |
|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-------|----|-------|----|-------|----|
| <b>39</b> | The emergence of numerous traders, who have facilitated a liquid and competitive market for crude oil and refined products, makes downstream vertical disintegration attractive for oil companies.            | 39 | -0.41 | 46 | 0.97  | 60 | -0.14 | 49 |
| <b>40</b> | The higher freight costs for moving refined products to Europe from outside the region, than the costs for moving crude oil, is a major reason for investments in refineries located in Europe.               | 40 | -1.13 | 39 | -0.99 | 40 | 0.55  | 56 |
| <b>41</b> | Asset-heavy strategies are becoming attractive because of the rise of financing and transaction costs due to regulatory changes in the banking and derivatives-trading environment.                           | 41 | -0.78 | 42 | -0.41 | 46 | -1.46 | 35 |
| <b>42</b> | A major reason for acquiring assets in the European downstream oil sector is for accessing new skills and capabilities in specific businesses within the oil value chain, for example oil products marketing. | 42 | -0.71 | 43 | -0.01 | 50 | -0.57 | 44 |

**Table 14: Factor Q-sort values for items sorted by Consensus vs. Disagreement (Variance across Factor z-Scores).**

| No.       | Statement                                                                                                                                                                                                         | No. | Factor Arrays |    |    |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---------------|----|----|
|           |                                                                                                                                                                                                                   |     | 1             | 2  | 3  |
| <b>31</b> | A major reason for converting unprofitable European refineries to terminals is mitigation of potential closure costs (including environmental, demolition, employee compensation and legal costs).                | 31  | 4             | 3  | 4  |
| <b>34</b> | The increasing activity from independent retailers/distributors and hypermarkets, is a major reason for acquiring storage facilities or converting refining facilities to storage in Europe.                      | 34  | -2            | -2 | 0  |
| <b>37</b> | The JVs of oil companies in the refining sector of non-European countries, help them shut refinery capacity in Europe and supply their wholesale and retail European networks with products from these countries. | 37  | -1            | -1 | -3 |
| <b>36</b> | An important reason for investing in the European downstream sector is risk and overheads spreading, as well as hedging against currency fluctuations.                                                            | 36  | -3            | -3 | -3 |
| <b>11</b> | The substantial surplus of refining capacity in Europe can only lead to divestments of refining assets.                                                                                                           | 11  | 5             | 4  | 4  |
| <b>30</b> | Investments in the European refining sector are important for job creation purposes.                                                                                                                              | 30  | 1             | -1 | 1  |
| <b>12</b> | Political pressure by European governments and labor unions on companies, is an important barrier for divestments of their uneconomic or poorly performing assets in Europe.                                      | 12  | 0             | 1  | 0  |
| <b>27</b> | A major driver for acquiring refineries in Europe is that you can gain a foothold in the region, without having to invest huge capital as many refineries are for sale at favorable prices.                       | 27  | 2             | 3  | 2  |
| <b>42</b> | A major reason for acquiring assets in the European downstream oil sector is for accessing new skills and capabilities in specific businesses within the oil value chain, for example oil products marketing.     | 42  | -3            | -1 | -3 |
| <b>39</b> | The emergence of numerous traders, who have facilitated a liquid and competitive market for crude oil and refined products, makes downstream vertical disintegration attractive for oil companies.                | 39  | 1             | 2  | 1  |
| <b>33</b> | The ownership of midstream physical assets in Europe and the creation of end-to-end supply chains open opportunities to gain access to exclusive and unpublished market information.                              | 33  | 0             | 0  | -3 |
| <b>4</b>  | Effective tax rates in Europe is an important driver for divestments in the European downstream oil sector.                                                                                                       | 4   | -1            | -3 | -2 |
| <b>23</b> | The declining North Sea production and Urals availability, combined with increased future availability of other crude blends, is a good reason to invest in changing the European refineries configuration.       | 23  | -1            | 0  | 2  |
| <b>41</b> | Asset-heavy strategies are becoming attractive because of the rise of financing and transaction costs due to regulatory changes in the banking and derivatives-trading environment.                               | 41  | -4            | -3 | -5 |

|    |                                                                                                                                                                                                         |    |    |    |    |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----|----|----|
| 40 | The higher freight costs for moving refined products to Europe from outside the region, than the costs for moving crude oil, is a major reason for investments in refineries located in Europe.         | 40 | -4 | -1 | -1 |
| 18 | European refiners should invest more in chemical operations, as they will be able to offer a broader slate of products which can cushion against market-demand swings for fuel products.                | 18 | 3  | 1  | 1  |
| 14 | A major reason for exiting the refining business in Europe is the strong labor laws and high wages.                                                                                                     | 14 | 1  | 0  | -3 |
| 19 | The current oversupply in the market will end, as smaller refineries close, therefore acquisitions of refineries in Europe can be justified.                                                            | 19 | 0  | -4 | -1 |
| 38 | Asset light strategies are preferred in Western Europe, due to the region's liquidity in petroleum products, good infrastructure, low refining margins and inadequate raw materials base.               | 38 | 0  | 3  | 0  |
| 20 | The higher volatility and lower returns from investments downstream, than the ones from investments upstream (crude oil production), are a major driver for divestments of downstream assets in Europe. | 20 | 3  | 4  | 1  |
| 3  | A major driver for acquiring downstream assets in Europe is because is a good way to help to serve the growing demand for fuels in Asian countries.                                                     | 3  | -3 | -5 | -3 |
| 35 | The mature European downstream market makes attractive the option to divest downstream assets in Europe and refocus on a strong downstream presence in other growth markets.                            | 35 | 4  | 1  | 3  |
| 16 | A major reason for acquiring storage facilities or converting refineries to storage in Europe, is compliance with compulsory stock obligations.                                                         | 16 | -5 | -2 | -1 |
| 22 | A major reason for acquiring refineries and/or storage facilities in Europe, is the region's strategic location which offers global connectivity and increased trading potential.                       | 22 | -2 | -1 | 2  |
| 17 | Acquisitions of refineries in Europe, is a good way to secure downstream outlets for your crude oil production and have a more efficient planning of output over time.                                  | 17 | -2 | 0  | 3  |
| 28 | A major reason for divesting downstream assets is to boost the stock price and/or increase dividend payments to shareholders.                                                                           | 28 | 0  | 3  | -4 |
| 15 | Most European refineries are configured to produce gasoline, however the European market demands more middle distillates, which is a major driver for upgrading investments in refineries.              | 15 | 3  | 1  | 5  |
| 1  | The growing competition European refiners face from their Russian counterparts in the European market, works mostly as an incentive for upgrading investments in European refineries.                   | 1  | -2 | -5 | 1  |
| 10 | The Compulsory Stock Obligation (CSO) represents a cost for the industry, as it does not allow it to run down its stocks to the lowest level consistent with its operational requirements.              | 10 | 2  | -4 | 0  |
| 2  | The fall of demand for gasoline in the US market is a significant driver for divestments in the European downstream oil sector.                                                                         | 2  | 1  | 5  | 3  |
| 29 | A major reason for acquiring European refineries and converting them to storage facilities for trading purposes, is that an established site simplifies compliance for environmental regulations.       | 29 | -3 | 2  | -1 |
| 8  | Acquisitions of less profitable downstream assets in Europe are justified for reasons of extended (foreign) policy reach through energy market control.                                                 | 8  | -1 | 0  | 4  |
| 13 | The growing competition European refiners face from their US counterparts worldwide, works mostly as an incentive for upgrading and expansion investments in European refineries.                       | 13 | 2  | -4 | -4 |
| 24 | Local opposition is a major barrier for expanding or upgrading refining facilities in Europe.                                                                                                           | 24 | 0  | -3 | -5 |
| 9  | Retaining sufficient refining capacity in Europe is a key factor for the region's energy security.                                                                                                      | 9  | 5  | 2  | 0  |
| 21 | Acquisition of midstream fixed logistic assets leads to better and faster exploitation of arbitrage opportunities.                                                                                      | 21 | -1 | 4  | -1 |
| 26 | Weak corporate balance sheets and the difficulty to access credit is a major barrier for investments in the European refining sector.                                                                   | 26 | 1  | -2 | 5  |
| 5  | The high taxes on emissions in Europe is a major driver for divestments of refining assets.                                                                                                             | 5  | 3  | 0  | -4 |
| 32 | A major reason for converting unprofitable European refineries to terminals is reduction of the plants' costs and release of working capital.                                                           | 32 | -4 | 2  | 2  |

|    |                                                                                                                                                                                                                                       |    |    |    |    |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----|----|----|
| 7  | The need to comply with the European environmental legislation (including biofuels mandates), works mostly as an incentive for upgrading investments in refineries.                                                                   | 7  | -5 | 1  | 3  |
| 25 | European refineries cannot compete with the new refineries in Asia and Middle East, as the latter are of high complexity and scale, and this works mostly as a driver for upgrading and expansion investments in European refineries. | 25 | 4  | -2 | 0  |
| 6  | Changes in supply and demand patterns in Europe is a major reason for acquisitions of storage facilities or conversion of refining facilities to storage in the region, to help handle the new commodity flows.                       | 6  | 2  | 5  | -2 |

Many of these consensus or disagreement items have already been presented in the main report, in paragraphs [5.3.1](#) and [5.3.2](#).

**Table 15: Factor characteristics.**

|                                  | Factors |       |       |
|----------------------------------|---------|-------|-------|
|                                  | 1       | 2     | 3     |
| <b>No. of Defining Variables</b> | 4       | 3     | 2     |
| <b>Average Rel. Coef.</b>        | 0.800   | 0.800 | 0.800 |
| <b>Composite Reliability</b>     | 0.941   | 0.923 | 0.889 |
| <b>S.E. of Factor Z-Scores</b>   | 0.243   | 0.277 | 0.333 |

**Table 16: Distinguishing Statements for Factor 1.**

| No. | Statement                                                                                                                                                                                                                             | No. | Factors |       |      |       |      |       |
|-----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---------|-------|------|-------|------|-------|
|     |                                                                                                                                                                                                                                       |     | 1       |       | 2    |       | 3    |       |
|     |                                                                                                                                                                                                                                       |     | Q-SV    | Z-SCR | Q-SV | Z-SCR | Q-SV | Z-SCR |
| 9   | Retaining sufficient refining capacity in Europe is a key factor for the region's energy security.                                                                                                                                    | 9   | 5       | 2.18* | 2    | 0.60  | 0    | 0.00  |
| 25  | European refineries cannot compete with the new refineries in Asia and Middle East, as the latter are of high complexity and scale, and this works mostly as a driver for upgrading and expansion investments in European refineries. | 25  | 4       | 1.72* | -2   | -0.85 | 0    | -0.18 |
| 15  | Most European refineries are configured to produce gasoline, however the European market demands more middle distillates, which is a major driver for upgrading investments in refineries.                                            | 15  | 3       | 1.42  | 1    | 0.47  | 5    | 2.24  |
| 18  | European refiners should invest more in chemical operations, as they will be able to offer a broader slate of products which can cushion against market-demand swings for fuel products.                                              | 18  | 3       | 1.29  | 1    | 0.47  | 1    | 0.27  |
| 5   | The high taxes on emissions in Europe is a major driver for divestments of refining assets.                                                                                                                                           | 5   | 3       | 0.89  | 0    | 0.12  | -4   | -1.52 |

|    |                                                                                                                                                                                                                 |    |    |        |    |       |    |       |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----|--------|----|-------|----|-------|
| 6  | Changes in supply and demand patterns in Europe is a major reason for acquisitions of storage facilities or conversion of refining facilities to storage in the region, to help handle the new commodity flows. | 6  | 2  | 0.61*  | 5  | 2.03  | -2 | -0.71 |
| 13 | The growing competition European refiners face from their US counterparts worldwide, works mostly as an incentive for upgrading and expansion investments in European refineries.                               | 13 | 2  | 0.38*  | -4 | -1.18 | -4 | -1.43 |
| 26 | Weak corporate balance sheets and the difficulty to access credit is a major barrier for investments in the European refining sector.                                                                           | 26 | 1  | 0.16   | -2 | -0.73 | 5  | 1.70  |
| 2  | The fall of demand for gasoline in the US market is a significant driver for divestments in the European downstream oil sector.                                                                                 | 2  | 1  | 0.00*  | 5  | 1.72  | 3  | 1.43  |
| 24 | Local opposition is a major barrier for expanding or upgrading refining facilities in Europe.                                                                                                                   | 24 | 0  | -0.11* | -3 | -1.13 | -5 | -2.24 |
| 40 | The higher freight costs for moving refined products to Europe from outside the region, than the costs for moving crude oil, is a major reason for investments in refineries located in Europe.                 | 40 | -4 | -1.23  | -1 | -0.33 | -1 | -0.36 |
| 32 | A major reason for converting unprofitable European refineries to terminals is reduction of the plants' costs and release of working capital.                                                                   | 32 | -4 | -1.35* | 2  | 0.63  | 2  | 0.98  |
| 7  | The need to comply with the European environmental legislation (including biofuels mandates), works mostly as an incentive for upgrading investments in refineries.                                             | 7  | -5 | -1.53* | 1  | 0.34  | 3  | 0.98  |
| 16 | A major reason for acquiring storage facilities or converting refineries to storage in Europe, is compliance with compulsory stock obligations.                                                                 | 16 | -5 | -1.84* | -2 | -0.58 | -1 | -0.54 |

[P < 0.05; Asterisk (\*) Indicates Significance at P < .01]. Both the Factor Q-Sort Value (Q-SV) and the Z-Score (Z-SCR) are shown.

**Table 17: Distinguishing Statements for Factor 2.**

| No. | Statement                                                                                                                                                                                                       | No. | Factors |       |      |       |      |       |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---------|-------|------|-------|------|-------|
|     |                                                                                                                                                                                                                 |     | 1       | 2     | 3    |       |      |       |
|     |                                                                                                                                                                                                                 |     | Q-SV    | Z-SCR | Q-SV | Z-SCR | Q-SV | Z-SCR |
| 6   | Changes in supply and demand patterns in Europe is a major reason for acquisitions of storage facilities or conversion of refining facilities to storage in the region, to help handle the new commodity flows. | 6   | 2       | 0.61  | 5    | 2.03* | -2   | -0.71 |
| 21  | Acquisition of midstream fixed logistic assets leads to better and faster exploitation of arbitrage opportunities.                                                                                              | 21  | -1      | -0.30 | 4    | 1.65* | -1   | -0.45 |
| 38  | Asset light strategies are preferred in Western Europe, due to the region's liquidity in petroleum products, good infrastructure, low refining margins and inadequate raw materials base.                       | 38  | 0       | -0.05 | 3    | 1.03* | 0    | -0.09 |
| 28  | A major reason for divesting downstream assets is to boost the stock price and/or increase dividend payments to shareholders.                                                                                   | 28  | 0       | -0.16 | 3    | 0.84* | -4   | -0.81 |
| 29  | A major reason for acquiring European refineries and converting them to storage facilities for trading purposes, is that an established site simplifies compliance for environmental regulations.               | 29  | -3      | -1.12 | 2    | 0.71* | -1   | -0.45 |

|    |                                                                                                                                                                                            |    |    |       |    |        |    |       |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----|-------|----|--------|----|-------|
| 15 | Most European refineries are configured to produce gasoline, however the European market demands more middle distillates, which is a major driver for upgrading investments in refineries. | 15 | 3  | 1.42  | 1  | 0.47   | 5  | 2.24  |
| 35 | The mature European downstream market makes attractive the option to divest downstream assets in Europe and refocus on a strong downstream presence in other growth markets.               | 35 | 4  | 1.58  | 1  | 0.16   | 3  | 1.07  |
| 5  | The high taxes on emissions in Europe is a major driver for divestments of refining assets.                                                                                                | 5  | 3  | 0.89  | 0  | 0.12   | -4 | -1.52 |
| 26 | Weak corporate balance sheets and the difficulty to access credit is a major barrier for investments in the European refining sector.                                                      | 26 | 1  | 0.16  | -2 | -0.73  | 5  | 1.70  |
| 24 | Local opposition is a major barrier for expanding or upgrading refining facilities in Europe.                                                                                              | 24 | 0  | -0.11 | -3 | -1.13  | -5 | -2.24 |
| 10 | The Compulsory Stock Obligation (CSO) represents a cost for the industry, as it does not allow it to run down its stocks to the lowest level consistent with its operational requirements. | 10 | 2  | 0.45  | -4 | -1.34  | 0  | -0.27 |
| 1  | The growing competition European refiners face from their Russian counterparts in the European market, works mostly as an incentive for upgrading investments in European refineries.      | 1  | -2 | -0.59 | -5 | -1.60* | 1  | 0.18  |
| 3  | A major driver for acquiring downstream assets in Europe is because is a good way to help to serve the growing demand for fuels in Asian countries.                                        | 3  | -3 | -1.23 | -5 | -2.15  | -3 | -0.81 |

[P < .05 ; Asterisk (\*) Indicates Significance at P < .01]. Both the Factor Q-Sort Value (Q-SV) and the Z-Score (Z-SCR) are shown.

**Table 18: Distinguishing Statements for Factor 3.**

| No. | Statement                                                                                                                                                                                                       | No. | Factors |       |      |       |      |        |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---------|-------|------|-------|------|--------|
|     |                                                                                                                                                                                                                 |     | 1       |       | 2    |       | 3    |        |
|     |                                                                                                                                                                                                                 |     | Q-SV    | Z-SCR | Q-SV | Z-SCR | Q-SV | Z-SCR  |
| 15  | Most European refineries are configured to produce gasoline, however the European market demands more middle distillates, which is a major driver for upgrading investments in refineries.                      | 15  | 3       | 1.42  | 1    | 0.47  | 5    | 2.24   |
| 26  | Weak corporate balance sheets and the difficulty to access credit is a major barrier for investments in the European refining sector.                                                                           | 26  | 1       | 0.16  | -2   | -0.73 | 5    | 1.70*  |
| 8   | Acquisitions of less profitable downstream assets in Europe are justified for reasons of extended (foreign) policy reach through energy market control.                                                         | 8   | -1      | -0.27 | 0    | 0     | 4    | 1.52*  |
| 17  | Acquisitions of refineries in Europe, is a good way to secure downstream outlets for your crude oil production and have a more efficient planning of output over time.                                          | 17  | -2      | -0.4  | 0    | -0.16 | 3    | 1.08*  |
| 22  | A major reason for acquiring refineries and/or storage facilities in Europe, is the region's strategic location which offers global connectivity and increased trading potential.                               | 22  | -2      | -0.53 | -1   | -0.44 | 2    | 0.81*  |
| 6   | Changes in supply and demand patterns in Europe is a major reason for acquisitions of storage facilities or conversion of refining facilities to storage in the region, to help handle the new commodity flows. | 6   | 2       | 0.61  | 5    | 2.03  | -2   | -0.71* |

|    |                                                                                               |    |   |       |    |       |    |        |
|----|-----------------------------------------------------------------------------------------------|----|---|-------|----|-------|----|--------|
| 5  | The high taxes on emissions in Europe is a major driver for divestments of refining assets.   | 5  | 3 | 0.89  | 0  | 0.12  | -4 | -1.52* |
| 24 | Local opposition is a major barrier for expanding or upgrading refining facilities in Europe. | 24 | 0 | -0.11 | -3 | -1.13 | -5 | -2.24  |

[P < .05 ; Asterisk (\*) Indicates Significance at P < .01]. Both the Factor Q-Sort Value (Q-SV) and the Z-Score (Z-SCR) are shown.

**Table 19: Consensus Statements -- Those that do not distinguish between any pair of Factors.**

| No. | Statement                                                                                                                                                                                                         | No. | Factors |       |      |       |      |       |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---------|-------|------|-------|------|-------|
|     |                                                                                                                                                                                                                   |     | 1       |       | 2    |       | 3    |       |
|     |                                                                                                                                                                                                                   |     | Q-SV    | Z-SCR | Q-SV | Z-SCR | Q-SV | Z-SCR |
| 4   | Effective tax rates in Europe is an important driver for divestments in the European downstream oil sector.                                                                                                       | 4   | -1      | -0.36 | -3   | -1.08 | -2   | -0.63 |
| 11* | The substantial surplus of refining capacity in Europe can only lead to divestments of refining assets.                                                                                                           | 11  | 5       | 2.00  | 4    | 1.51  | 4    | 1.61  |
| 12* | Political pressure by European governments and labor unions on companies, is an important barrier for divestments of their uneconomic or poorly performing assets in Europe.                                      | 12  | 0       | -0.11 | 1    | 0.34  | 0    | -0.18 |
| 18  | European refiners should invest more in chemical operations, as they will be able to offer a broader slate of products which can cushion against market-demand swings for fuel products.                          | 18  | 3       | 1.29  | 1    | 0.47  | 1    | 0.27  |
| 23* | The declining North Sea production and Urals availability, combined with increased future availability of other crude blends, is a good reason to invest in changing the European refineries configuration.       | 23  | -1      | -0.21 | 0    | 0.02  | 2    | 0.54  |
| 27* | A major driver for acquiring refineries in Europe is that you can gain a foothold in the region, without having to invest huge capital as many refineries are for sale at favorable prices.                       | 27  | 2       | 0.64  | 3    | 1.09  | 2    | 0.44  |
| 30* | Investments in the European refining sector are important for job creation purposes.                                                                                                                              | 30  | 1       | 0.18  | -1   | -0.31 | 1    | 0.18  |
| 31* | A major reason for converting unprofitable European refineries to terminals is mitigation of potential closure costs (including environmental, demolition, employee compensation and legal costs).                | 31  | 4       | 1.53  | 3    | 1.29  | 4    | 1.52  |
| 33* | The ownership of midstream physical assets in Europe and the creation of end-to-end supply chains open opportunities to gain access to exclusive and unpublished market information.                              | 33  | 0       | -0.19 | 0    | -0.18 | -3   | -0.80 |
| 34* | The increasing activity from independent retailers/distributors and hypermarkets, is a major reason for acquiring storage facilities or converting refining facilities to storage in Europe.                      | 34  | -2      | -0.64 | -2   | -0.63 | 0    | -0.27 |
| 36* | An important reason for investing in the European downstream sector is risk and overheads spreading, as well as hedging against currency fluctuations.                                                            | 36  | -3      | -1.21 | -3   | -1.07 | -3   | -0.72 |
| 37* | The JVs of oil companies in the refining sector of non-European countries, help them shut refinery capacity in Europe and supply their wholesale and retail European networks with products from these countries. | 37  | -1      | -0.22 | -1   | -0.58 | -3   | -0.72 |
| 39* | The emergence of numerous traders, who have facilitated a liquid and competitive market for crude oil and refined products, makes downstream vertical disintegration attractive for oil companies.                | 39  | 1       | -0.03 | 2    | 0.65  | 1    | 0.18  |

|            |                                                                                                                                                                                                               |    |    |       |    |       |    |       |
|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|----|-------|----|-------|----|-------|
| <b>40</b>  | The higher freight costs for moving refined products to Europe from outside the region, than the costs for moving crude oil, is a major reason for investments in refineries located in Europe.               | 40 | -4 | -1.23 | -1 | -0.33 | -1 | -0.36 |
| <b>41*</b> | Asset-heavy strategies are becoming attractive because of the rise of financing and transaction costs due to regulatory changes in the banking and derivatives-trading environment.                           | 41 | -4 | -1.36 | -3 | -0.86 | -5 | -1.61 |
| <b>42*</b> | A major reason for acquiring assets in the European downstream oil sector is for accessing new skills and capabilities in specific businesses within the oil value chain, for example oil products marketing. | 42 | -3 | -1.04 | -1 | -0.37 | -3 | -0.72 |

All listed Statements are non-significant at  $P > 0.01$ , and those flagged with an \* are also non-significant at  $P > 0.05$ . These statements have been presented in the main report (Table 5 at paragraph [5.3.1](#)).

## Bibliography

Watts, S., & Stenner, P. (2012). *Doing Q Methodological Research*. London: SAGE Publications Ltd.

## Appendix G: Detailed lists of items used for Factors interpretation

The lists below present the items used for the interpretation of the 3 extracted Factors.

### Factor 1

For Factor 1, the items presented are the items that received the highest and lowest scores in Factor 1 array. Moreover, these items are accompanied by the items that received the highest and the lowest scores in Factor 1 array, than in any other factor arrays, together with their scores (in the parentheses). Last but not least, all the distinguishing items, as provided by PQMethod, are written in *italics*. The tables with the distinguishing statements for all the factor arrays can also be found in Appendix F of this report.

#### Agree (+5)

9: *Retaining sufficient refining capacity in Europe is a key factor for the region's energy security.*

11: The substantial surplus of refining capacity in Europe can only lead to divestments of refining assets.

#### Agree (+4)

25: *European refineries cannot compete with the new refineries in Asia and Middle East, as the latter are of high complexity and scale, and this works mostly as a driver for upgrading and expansion investments in European refineries.*

31: A major reason for converting unprofitable European refineries to terminals is mitigation of potential closure costs (including environmental, demolition, employee compensation and legal costs).

35: The mature European downstream market makes attractive the option to divest downstream assets in Europe and refocus on a strong downstream presence in other growth markets.

#### Disagree (-5)

7: *The need to comply with the European environmental legislation (including biofuels mandates), works mostly as an incentive for upgrading investments in refineries.*

16: *A major reason for acquiring storage facilities or converting refineries to storage in Europe, is compliance with compulsory stock obligations.*

#### Disagree (-4)

32: *A major reason for converting unprofitable European refineries to terminals is reduction of the plants' costs and release of working capital.*

40: *The higher freight costs for moving refined products to Europe from outside the region, than the costs for moving crude oil, is a major reason for investments in refineries located in Europe.*

41: Asset-heavy strategies are becoming attractive because of the rise of financing and transaction costs due to regulatory changes in the banking and derivatives-trading environment.

### **Items ranked higher in Factor 1 array than in any other Factor arrays**

4: Effective tax rates in Europe is an important driver for divestments in the European downstream oil sector. (-1)

5: *The high taxes on emissions in Europe is a major driver for divestments of refining assets. (+3)*

10: The Compulsory Stock Obligation (CSO) represents a cost for the industry, as it does not allow it to run down its stocks to the lowest level consistent with its operational requirements. (+2)

13: *The growing competition European refiners face from their US counterparts worldwide, works mostly as an incentive for upgrading and expansion investments in European refineries. (+2)*

14: A major reason for exiting the refining business in Europe is the strong labor laws and high wages. (+1)

18: *European refiners should invest more in chemical operations, as they will be able to offer a broader slate of products which can cushion against market-demand swings for fuel products. (+3)*

19: The current oversupply in the market will end, as smaller refineries close, therefore acquisitions of refineries in Europe can be justified. (0)

24: *Local opposition is a major barrier for expanding or upgrading refining facilities in Europe. (0)*

### **Items ranked lower in Factor 1 array than in any other Factor arrays**

2: *The fall of demand for gasoline in the US market is a significant driver for divestments in the European downstream oil sector. (+1)*

8: Acquisitions of less profitable downstream assets in Europe, are justified for reasons of extended (foreign) policy reach through energy market control. (-1)

17: Acquisitions of refineries in Europe, is a good way to secure downstream outlets for your crude oil production and have a more efficient planning of output over time. (-2)

22: A major reason for acquiring refineries and/or storage facilities in Europe, is the region's strategic location which offers global connectivity and increased trading potential. (-2)

23: The declining North Sea production and Urals availability, combined with increased future availability of other crude blends, is a good reason to invest in changing the European refineries configuration. (-1)

29: A major reason for acquiring European refineries and converting them to storage facilities for trading purposes, is that an established site simplifies compliance for environmental regulations. (-3)

### **Other distinguishing items**

15: *Most European refineries are configured to produce gasoline, however the European market demands more middle distillates, which is a major driver for upgrading investments in refineries. (+3)*

6: *Changes in supply and demand patterns in Europe is a major reason for acquisitions of storage facilities or conversion of refining facilities to storage in the region, to help handle the new commodity flows. (+2)*

26: *Weak corporate balance sheets and the difficulty to access credit is a major barrier for investments in the European refining sector. (+1)*

## Factor 2

The most important items related to Factor 2 array are presented below, in a similar way as it was conducted for Factor 1 array.

### Agree (+5)

2: The fall of demand for gasoline in the US market is a significant driver for divestments in the European downstream oil sector.

*6: Changes in supply and demand patterns in Europe is a major reason for acquisitions of storage facilities or conversion of refining facilities to storage in the region, to help handle the new commodity flows.*

### Agree (+4)

11: The substantial surplus of refining capacity in Europe can only lead to divestments of refining assets.

20: Acquisition of midstream fixed logistic assets leads to better and faster exploitation of arbitrage opportunities.

*21: The higher volatility and lower returns from investments downstream, than the ones from investments upstream (crude oil production), are a major driver for divestments of downstream assets in Europe.*

### Disagree (-5)

*1: The growing competition European refiners face from their Russian counterparts in the European market, works mostly as an incentive for upgrading investments in European refineries.*

*3: A major driver for acquiring downstream assets in Europe is because is a good way to help to serve the growing demand for fuels in Asian countries.*

### Disagree (-4)

*10: The Compulsory Stock Obligation (CSO) represents a cost for the industry, as it does not allow it to run down its stocks to the lowest level consistent with its operational requirements.*

13: The growing competition European refiners face from their US counterparts worldwide, works mostly as an incentive for upgrading and expansion investments in European refineries.

19: The current oversupply in the market will end, as smaller refineries close, therefore acquisitions of refineries in Europe can be justified.

### Items ranked higher in Factor 1 array than in any other Factor arrays

12: Political pressure by European governments and labor unions on companies, is an important barrier for divestments of their uneconomic or poorly performing assets in Europe. (+1)

27: A major driver for acquiring refineries in Europe is that you can gain a foothold in the region, without having to invest huge capital as many refineries are for sale at favorable prices. (+3)

*28: A major reason for divesting downstream assets is to boost the stock price and/or increase dividend payments to shareholders. (+3)*

*29: A major reason for acquiring European refineries and converting them to storage facilities for trading purposes, is that an established site simplifies compliance for environmental regulations. (+2)*

38: *Asset light strategies are preferred in Western Europe, due to the region's liquidity in petroleum products, good infrastructure, low refining margins and inadequate raw materials base. (+3)*

39: The emergence of numerous traders, who have facilitated a liquid and competitive market for crude oil and refined products, makes downstream vertical disintegration attractive for oil companies. (+2)

41: Asset-heavy strategies are becoming attractive because of the rise of financing and transaction costs due to regulatory changes in the banking and derivatives-trading environment. (-3)

42: A major reason for acquiring assets in the European downstream oil sector is for accessing new skills and capabilities in specific businesses within the oil value chain, for example oil products marketing. (-1)

### **Items ranked lower in Factor 1 array than in any other Factor arrays**

4: Effective tax rates in Europe is an important driver for divestments in the European downstream oil sector. (-3)

15: *Most European refineries are configured to produce gasoline, however the European market demands more middle distillates, which is a major driver for upgrading investments in refineries. (+1)*

25: European refineries cannot compete with the new refineries in Asia and Middle East, as the latter are of high complexity and scale, and this works mostly as a driver for upgrading and expansion investments in European refineries. (-2)

26: *Weak corporate balance sheets and the difficulty to access credit is a major barrier for investments in the European refining sector. (-2)*

30: Investments in the European refining sector are important for job creation purposes. (-1)

31: A major reason for converting unprofitable European refineries to terminals is mitigation of potential closure costs (including environmental, demolition, employee compensation and legal costs). (+3)

35: *The mature European downstream market makes attractive the option to divest downstream assets in Europe and refocus on a strong downstream presence in other growth markets. (+1)*

### **Other distinguishing items**

5: *The high taxes on emissions in Europe is a major driver for divestments of refining assets. (0)*

24: *Local opposition is a major barrier for expanding or upgrading refining facilities in Europe. (-3)*

## **Factor 3**

The most important items related to Factor 3 array are presented below, in a similar way as it was conducted for the previous factor arrays.

### **Agree (+5)**

15: *Most European refineries are configured to produce gasoline, however the European market demands more middle distillates, which is a major driver for upgrading investments in refineries.*

26: *Weak corporate balance sheets and the difficulty to access credit is a major barrier for investments in the European refining sector.*

### **Agree (+4)**

8: *Acquisitions of less profitable downstream assets in Europe, are justified for reasons of extended (foreign) policy reach through energy market control.*

11: The substantial surplus of refining capacity in Europe can only lead to divestments of refining assets.

31: A major reason for converting unprofitable European refineries to terminals is mitigation of potential closure costs (including environmental, demolition, employee compensation and legal costs).

### **Disagree (-5)**

24: *Local opposition is a major barrier for expanding or upgrading refining facilities in Europe.*

41: Asset-heavy strategies are becoming attractive because of the rise of financing and transaction costs due to regulatory changes in the banking and derivatives-trading environment.

### **Disagree (-4)**

5: *The high taxes on emissions in Europe is a major driver for divestments of refining assets.*

13: The growing competition European refiners face from their US counterparts worldwide, works mostly as an incentive for upgrading and expansion investments in European refineries.

28: A major reason for divesting downstream assets is to boost the stock price and/or increase dividend payments to shareholders.

### **Items ranked higher in Factor 1 array than in any other Factor arrays**

1: The growing competition European refiners face from their Russian counterparts in the European market, works mostly as an incentive for upgrading investments in European refineries. (+1)

7: The need to comply with the European environmental legislation (including biofuels mandates), works mostly as an incentive for upgrading investments in refineries. (+3)

16: A major reason for acquiring storage facilities or converting refineries to storage in Europe, is compliance with compulsory stock obligations. (-1)

17: *Acquisitions of refineries in Europe, is a good way to secure downstream outlets for your crude oil production and have a more efficient planning of output over time. (+3)*

22: *A major reason for acquiring refineries and/or storage facilities in Europe, is the region's strategic location which offers global connectivity and increased trading potential. (+2)*

23: The declining North Sea production and Urals availability, combined with increased future availability of other crude blends, is a good reason to invest in changing the European refineries configuration. (+2)

34: The increasing activity from independent retailers/distributors and hypermarkets, is a major reason for acquiring storage facilities or converting refining facilities to storage in Europe. (0)

### **Items ranked lower in Factor 1 array than in any other Factor arrays**

6: *Changes in supply and demand patterns in Europe is a major reason for acquisitions of storage facilities or conversion of refining facilities to storage in the region, to help handle the new commodity flows. (-2)*

9: Retaining sufficient refining capacity in Europe is a key factor for the region's energy security. (0)

14: A major reason for exiting the refining business in Europe is the strong labor laws and high wages. (-3)

20: The higher volatility and lower returns from investments downstream, than the ones from investments upstream (crude oil production), are a major driver for divestments of downstream assets in Europe. (+1)

33: The JVs of oil companies in the refining sector of non-European countries, help them shut refinery capacity in Europe and supply their wholesale and retail European networks with products from these countries. (-3)

37: The ownership of midstream physical assets in Europe and the creation of end-to-end supply chains open opportunities to gain access to exclusive and unpublished market information. (-3)

### **Other distinguishing items**

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