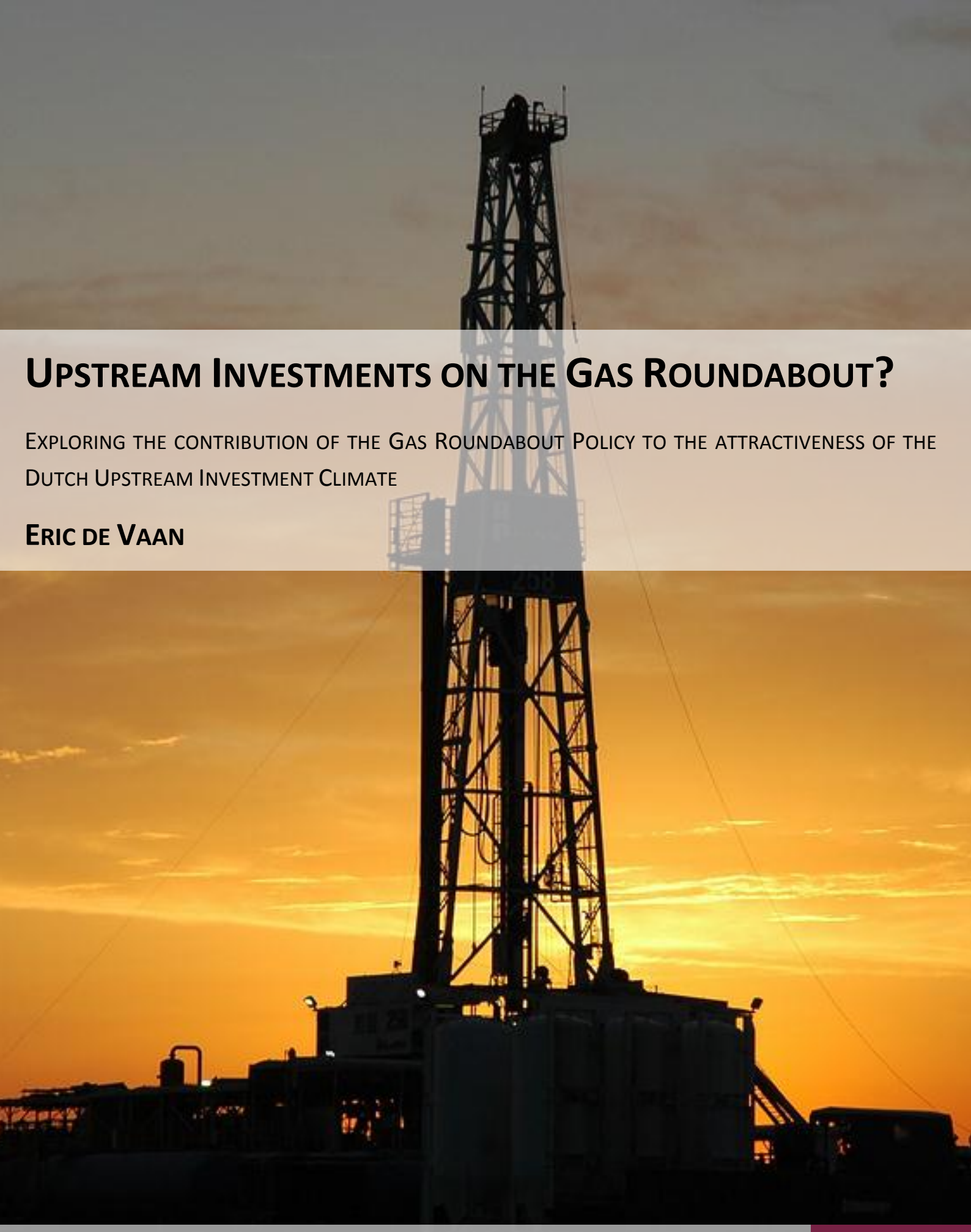

UPSTREAM INVESTMENTS ON THE GAS ROUNDABOUT?

EXPLORING THE CONTRIBUTION OF THE GAS ROUNDABOUT POLICY TO THE ATTRACTIVENESS OF THE DUTCH UPSTREAM INVESTMENT CLIMATE

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PROJECT DETAILS

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PREFACE AND ACKNOWLEDGEMENTS

This thesis is the final deliverable for the completion of the Msc.-program Systems Engineering, Policy Analysis and Management (SEPAM) at the Delft University of Technology. Given the program focus on policy analysis and complex socio-technical multi-actor systems, and my domain choice on energy, this specific research was a beneficial occasion to exploit and further develop my research and analytical skills on the one hand and my knowledge of the energy sector on the other hand. From the beginning on I have made clear my high ambitions for this research. I aimed to tackle a relevant and complex problem within the upstream natural gas industry and aimed to deliver a scientific contribution. The thesis in front of you presents these results, the product of a highly educational process which took me seven months.

During this process I found myself in many challenging situations. I was not familiar with the upstream natural gas industry or most of the theories applied in this research. As EBN gave me the opportunity to conduct this research within their office and introduced me to many operators, this first hurdle could be taken. Meetings with my first supervisor Aad Correljé further enriched my insight in the upstream natural gas industry, and supported me to place extensive amounts of literature, insights from many interviews and many other ideas into a scientific perspective. Meetings with Martijn Groenleer and John Groenewegen, but also reading and re-reading of numerous articles, allowed me to become aware of the essence of the applied theories in this thesis. I encountered that a *diverging* process is inevitably required before one can start with *converging*. Converging a variety of opinions, theories, insights and sub-issues into one thesis requires explicit choices. This was certainly one of the most important lessons learned during this research process. My ambition, interest for research in general and energy particular, the support from supervisors and all inspiring people I met during this process allowed me to face all challenges I met during this research process. Now I am proud of the result.

Therefore, I would like to thank EBN for giving me the opportunity to perform my graduation project within their company. Never, I felt a struggle between the company's research goals and the objectives within the university. The willingness of EBN to introduce me to senior managers of operators and the Ministry of EL&I significantly contributed to the quality of work and provided me with the required empirical insights. In particular, I would like to thank Sander de Jong for all interesting discussions and fantastic supervision and support. It was a great pleasure to work with Sander, and his involvement in my graduation project was enriching both in terms of motivation, pleasure, defiance and content.

Moreover, I would like to thank my first supervisor Aad Correljé. It was inspiring and educational to work with Aad for his profound knowledge on the Dutch natural gas value chain, Dutch energy policy and some of the applied theories in this research. Evenly important was his stimulant for me to make choices, and to take the initiative to creatively work with the theories. I enjoyed our discussions and meetings, which often comprised keen and amusing dialogues. Also, I would like to thank Martijn Groenleer for his support on the policy-analysis element of this research. In-depth discussions with Martijn on approaches to policy-analysis enabled me to place the *gas roundabout policy* in the right perspective. Additionally, I would like the chair of my graduation committee John Groenewegen. Meetings and correspondences with John stimulated me to look for the *scientist* in myself and largely contributed to the scientific result of this thesis. It was a fascinating experience to have multiple discussions, phone-calls and mail-contacts about just two small articles, which eventually became elementary pillars of my thesis. This gave me a glimpse of what advanced academic research comprises, and I enjoyed this experience very much.

Finally, I would like to thank the people who supported me during my entire study period in Delft. In the first place, I am very thankful to my parents. I am gratified with both the freedom and support my parents have given me during my studies. Most of all, I consider myself to be very fortunate with the fantastic friends and Eline around me during the past years.

It was a great pleasure to study and to be a student in Delft.

Eric de Vaan Delft, 21-09-2012

"We can't solve problems by using the same kind of thinking we used when we created them."

Albert Einstein (1879-1955)

DISCLAIMER

SUMMARY

INTRODUCTION AND RESEARCH OBJECTIVES

In order to re-position the Dutch natural gas system within a changing European and global context, the Dutch government has developed the *gas roundabout policy*. This policy is aimed at the security of supply and to valorize the Dutch *competitive advantages* related to the natural gas system. One of these competitive advantages is the Dutch exploration and production (E&P) of natural gas. An important element of the gas roundabout policy is therefore to contribute to the attractiveness of the Dutch upstream investment climate. The policy aims to realize a *small-fields* production level of 30 bcm in 2030, which would contribute an additional 230 billion cubic meters (bcm) of Dutch small-fields production to the *business-as-usual* scenario. As this requires market parties to invest in E&P activities, the Dutch ministry of Economic Affairs, Agriculture and Innovation (EL&I) has formulated their role as twofold:

(i) actively setting the right regulatory regime and decision making process, in cooperation with the industry, and;
(ii) actively facilitating investments by deploying certain policy means.

EBN, the state-participant in almost all E&P activities in the Netherlands and one of the main advising bodies to the Dutch government on the investment climate, wants to know the extent to which the gas roundabout policy contributes to the attractiveness of the Dutch upstream investment climate. This question is triggered by two governmental reports on the gas roundabout policy, with contradicting conclusions. According to the first report, the gas roundabout policy would results in an additional 230 bcm of small-fields production, among other midstream developments as a result of the gas roundabout policy (Brattle, 2010). The second report criticized the gas roundabout policy as the policy was considered *unsubstantiated* (Dutch Chamber of Audits, 2012). These contradicting conclusions have triggered EBN to question how the policy could be analyzed and evaluated, and to what extent the gas roundabout succeeds in:

(i) actively setting the regulatory regime and decision making process, and;
(ii) actively facilitating upstream investments.

Accordingly, the practical objective of this study will be to answer both questions. In addition to that, the final part of this summary will emphasize on the scientific objective of this study. Conclusions will follow.

THE GAS ROUNDABOUT POLICY

Although the gas roundabout policy is aimed at the entire Dutch natural gas value chain, this study will only address the intended contribution of the gas roundabout policy to the attractiveness of the Dutch upstream investments, which is twofold. On the one hand, the policy intends to *directly* contribute to the upstream investment climate by deploying a set of policy instruments:

(i) continuation of the Small-Fields Policy (SFP);
(ii) an adjustment of the Mining Act;
(iii) the Fallow Acreage covenant;
(iv) the fiscal marginal investment allowance for off-shore fields, and;
(v) innovation contracts.

On the other hand, the gas roundabout policy *indirectly* contributes to the upstream investment climate by aiming for a midstream structure which is characterized by a *physical* and *virtual gas hub*. This structure is aimed to attract more physical gas-streams to the Netherlands, mainly traded on a liquid exchange (TTF). Dutch upstream producers are intended beneficiaries of the structure as well, allowing them to sell their natural gas on the TTF.

THE RIGHT REGULATORY REGIME?

To determine how the gas roundabout policy can be analyzed and evaluated, two approaches to policy making, -analysis and -evaluation will be compared: the project-approach, and the process-approach. Depending on the context- and the nature of the problem, the content of the policy, and the characteristics of the decision making process, the *process*-approach will be identified as most relevant approach for this study.

The gas roundabout policy attempts to *satisfy* a dynamic and *wicked* problem within a network of actors which is characterized by *mutual dependency, information asymmetry,* a large *variety* and *closedness.* The scope and content of the gas roundabout policy is therefore very dynamic, and adaptive to external political-, industry-, market- and actor developments. To analyze the *regulatory regime,* this study will make a distinction between the policy objectives, the policy instruments, and the decision making process.

Firstly, the policy objective will be analyzed by *tracing* the *distinctness* of the objective to add 230 bcm of natural gas to the *business as usual scenario*. The existence of this objective is found to be independent from the existence of the gas roundabout policy. However, this objective has proven to be *adaptive* and willing to *learn substantively* from the *problem perception* of the actor-network. Moreover, the broad objective allowed for *goal stretching,* resulting in possible support from actors as they can *tag* their issues to the *frame* gas roundabout. EL&I also used this objective for *coupling* and *de-coupling* of issues. From a process-perspective, this can be a useful strategy to gather support and substance from the actor-network.

Secondly, the five instruments of the gas roundabout policy – aimed to actively facilitate upstream investments – will be analyzed by *tracing.* It will be identified that the existence of none of these instruments depends on the existence of the gas roundabout policy. All instruments are derived from existing policies (SFP), other policy-domains (innovation contracts) or measures which would also have been implemented without the gas roundabout policy (Fallow Acreage, Fiscal Allowance and the Adjustment of the Mining Act), as a result of the evaluation of the Mining Act.

The gas roundabout thus did not actively contribute to existence of the regulatory regime. Yet, the *frame* can be useful for EL&I and the actor-network in many forms. First of all, it provides a tool for EL&I to *conceptualize* their beliefs on the future position of the Dutch natural gas system (a *policy*-frame). Secondly, the *frame* allows EL&I and other actors to realize *process-objectives* as it creates a *common issue* and brings together actors which are stimulated to think *beyond* their individual *problem perceptions.* It additionally creates a *sense of urgency* and a *window of opportunity* for actors to *tag* their individual issues to the common frame. The *open* and *adaptive* nature of the frame is appropriate for the *closedness* of the network, in which all different parties are given the opportunity to put forward their individual projects, problems and solutions as a part of the *gas roundabout.* It is also explanatory for the independence of the instruments and objectives from the gas roundabout policy: they were *tagged*. In the end, the question will be to what extent this frame contributes to the attractiveness of the Dutch upstream investments climate. As the *frame* has not succeeded in bringing about an effective decision making process (see below), neither has there been positional or substantive learning of parties, the *information asymmetry* was not mitigated with that. No mutual problem perception was developed subsequently, and solutions were not negotiated upon. To gather substance and support – two essential elements which can be realized by a *frame* succeeded by a proper decision making process – EL&I will be recommended to take a next step. This involves a *frame* tailored to the upstream investment climate, as the current scope of the *frame* might not be aligned with the interest of upstream actors, and a more *active* decision making process.

The decision making process will be characterized as a hybrid mode for decision making, comprising of *interactive decision making* by means of the *gas hub consultative platform* in which *some* parties consulted EL&I, and complemented by *hierarchical* decision-making by EL&I on the actual policy objectives and instruments. This decision-making process will be analyzed and evaluated from a *process*-approach. The fact that EL&I established the *platform* will be explained by their need to generate *substance* on the problems and solutions in the upstream industry, but also because they rely on *support* of the actor-network for realizing

their objectives – the *mutual dependency*. Only several large and medium firms were invited to the platform. The fact that the current actor-landscape comprises of more firms, which were not invited to the *platform*, makes the process limitedly fair. An explanation to this could be the dynamics of this actor-landscape (many small firms entered the Netherlands over the recent years), the path-dependent reliance of EL&I on certain actors for consult, or *power and politics*. Besides, there are other arenas in which small firms have the chance to put forward their issues (e.g. bi-lateral interaction). As a result of this limitedly fairness, many residual issues threatening the attractiveness of the Dutch upstream investment climate are overlooked by the policy. The new operator-landscape – comprising of many new small and medium firms – is associated with new problems and solutions (see below), which must be incorporated in the policy to actively facilitate upstream investments. Also, the path-dependent view of EL&I did not result in an exploration of issues which are associated with the current declining phase of the Dutch upstream industry. Due to the limited number of parties involved, important issues already known to EL&I (e.g. the *shadow of decommissioning*, large firms *sitting on assets*) were not allocated with the actual sense of urgency. This demands a future decision-making process which involves *all* relevant actors. Apart from the process being limitedly fair, the applied *interactive decision making process* also had other limitations. Firstly, the applied process is aimed at consultation, where positional and substantial learning of the parties – as a result of negotiating – would result in more substantive insight for EL&I about the main issues in the industry. Secondly, the applied process did not stimulate private-cooperation, which was meant to be an important pathway to mitigate the current and future issues in the industry.

It will thus be recommended to make the decision-making process more *satisfying*. This can be achieved by *re-framing* the upstream part of the *gas roundabout* policy, and aggregating it to the level of upstream investments. Lessons could be learned from the UK and Norway, where specific upstream decision making processes – "PILOT" and "OG21" – resulted in interest, substance and support from the industry, common problem perceptions and many public-private and private initiatives to maximize upstream production. A need-based design of a more proper decision making process can also be deployed in the Netherlands. A feasibility study to establish a "Dutch PILOT" will be recommended. To develop such an initiative, and to compensate for the limitations of the currently applied *interactive decision making*, a "*process managerial approach"* will be recommended. A fair and proper decision-making process, *framed* and conducted according to the needs of the upstream industry and EL&I, can contribute in setting the right regulatory regime and decision making process.

FACILITATING INVESTMENTS?

To determine the extent to which the gas roundabout policy actively facilitates investment, the contribution of the described *direct* and *indirect* contributing factors will be analyzed by applying the developed "pluralistic theory of the firm." By applying this theory, assumptions can be made about:

(i) which elements determine the attractiveness of the Dutch upstream investments climate, and;
(ii) how the gas roundabout policy contributes to these elements.

The *direct contributing factors* positively contribute to the extent to which the gas roundabout policy facilitates upstream investments. The five policy instruments actively facilitate investments in projects and enable firms to produce an additional 121 bcm over the period 2010-2030, under the condition that these instruments are deployed optimally. Benchmarked with the UK, adjusting the Mining Act and the Fallow Acreage covenant have the potential to facilitate investments for 96 bcm. The marginal investment allowance for off-shore fields facilitate another 25 bcm. The innovation contracts are expected to have *some* positive contribution, but directly deriving additional bcm's is challenging. Continuation of the small-fields policy (SFP) positively contributes to the *transaction costs* associated with selling natural gas. GasTerra's market conform conditions and off-take guarantee lower the market uncertainty – the main driver of transaction costs – and consequently the potential *power of buyers* to capture upstream producers' rents. In addition to that, selling natural gas to GasTerra lowers the possible risk of opportunism, caused by arbitration in the *hybrid* gas roundabout market structure by buyers, at the expense of producers.

With regard to the *indirect contribution* of the gas roundabout policy, the developments of a physical and virtual hub result in additional alternatives for producers to sell gas. The extent to which the governance attributes actually contribute to reduced transaction costs strongly depends on the liquidity of the exchange (TTF). The higher incentive intensity and autonomous adaptation – which originates from the presence of the exchange – must be approached from the point of view of upstream investments, which have technical and economic characteristics, other than that of firms in traditional economic books. The biggest *indirect contribution* of the gas roundabout policy to the market structure is associated with the development of gas-to-gas pricing, both on the exchange and in long-term contracts. De-coupling gas prices from oil will not automatically result in *lower* prices; the shift to gas-to-gas pricing only involves more *volatile* prices. The presence of well-functioning derivates markets is elementary to mitigate this volatility. Market uncertainties can also be mitigated by a liquid and well-functioning exchange (TTF). In this sense, the gas roundabout policy creates a market structure which is *redundant* for responding to demand- and price uncertainties. Engaging in the exchange, with low transaction costs, gives producers luxury of choice – but will not especially result in a more attractive investment climate.

This *redundant* or *hybrid* structure can trigger the policymakers to consider the effectiveness of the SFP when a mature market has materialized. The most important lesson will be that policymakers should re-think their *old buttons* (adjusting midstream elements) to facilitate upstream investments as these may have lost their effectiveness in the new market- and industry structure and context. Applying another, more *pluralistic*, perspective – taking account the *interactionistic* elements of the research domain – can certainly add to such an exercise.

Applying the "pluralistic theory of the firm" will also identified *residual* and *new* issues, which negatively contribute to the attractiveness of the Dutch upstream investment climate. Due to the changed operator landscape, and the maturing phase of the Dutch industry, the following issues will be found to become increasingly important to take into consideration by the policymakers. This study will also recommend some measures, which could mitigate these issues:

TABLE I: ISSUES AND RECOMMENDATIONS

Issue	Recommended measures to EL&I, aimed to more actively facilitate investments
Sub-optimal exploration activities	Evaluate and adjust Fallow Acreage: move towards the more stringent UK-model to valorize the significant potential
	Consider the possibilities for more *tailored* licensing, permitting and Fallow Acreage regimes – depending on the type of project (e.g. onshore – offshore, conventional – tough, vertical licensing, de-couple exploration and production)
	Consider to apply the Marginal Investment Allowance also for on-shore projects
	Consider the possibilities for "sole-risk operations" by EBN
	Consider "Promote Licenses" for unpopular underexplored acreage
	Evaluate the availability and quality of sub-surface information
Sub-optimal production activities	Consider "Stewardship" to valorize the potential upside of tail-end production, to prevent that operators are *sitting on assets*, to reduce opex – and with that indirectly extend the viable recovery period – and to increase the availability of production plays
	Consider to integrate innovation contracts or other joint-industry-projects to new business-models such as gas-to-wire and gas-to-liquids
	Consider fiscal measures for certain technologies to stimulate activities in tail-end and tough projects
Increasing opex	Facilitate possibilities for joint-bargaining at suppliers and resource sharing
	Increase allocative efficiency, planning and transparency by valorizing EBN's overview

	function
	Increase operational performances as part of "Stewardship's" benchmarks
Regulatory burdens and public resistance on-shore	Consider the opportunity to establish one central agency for licensing and permitting to streamline central and local governments
	Consider the possibility to apply the *Rijkscoordinatie-regeling* for critical projects
	Evaluate and optimize the role in stakeholder engagement, including fiscal benefits for firms to compensate local citizens
Shadow of decommissioning for off-shore infrastructure	Investigate the possibilities for government involvement in off-shore infrastructure (e.g. increase equity EBN, regulate TPA and tariffs, increase burdens for decommissioning)
	Establish a long-term infrastructure strategy together with the industry, identify critical infrastructures and consider targeted approached (e.g. EBN equity) for optimal utilization and long-term availability of infrastructure
	Increase transparency about decommissioning, tariffs, access and availability for acquisitions of infrastructure-assets
	Actively approach new firms, adding to industry needs (e.g. tail-end or tough projects) by increase information availability of opportunities, benchmarks, and available assets for acquisition. Increase communication or even "marketing" by e.g. organizing foreign "road-shows"

One of the main messages this study will convey is that a proper decision-making process is strongly interrelated with thorough insight about the research domain. Therefore, the set of issues and possible solutions presented above should be *ranked* and further substantiated by EL&I in close dialogue with the industry. By moving towards a regulatory regime which more actively facilitates upstream investments – together with the industry – the main *competitive advantage* of the Dutch natural gas system can be valorized. This will not only benefit upstream actors, but also the security of supply, midstream market maturation, economic output and employment.

SCIENTIFIC CONTRIBUTION

Apart from the practical objective, this study will also contribute to a scientific knowledge gap. There is not one suitable method to analyze the contribution of policy to the research domain "upstream investments", from a scientific point of view. For this reason, multiple theoretical perspectives will be applied, combined and developed in this study to contribute to that scientific need.

The choice for a suitable *policy analysis and evaluation perspective* depends on the context and nature of the problem, the content and objectives of the policy, and the decision making process and actor-involvement. Two perspectives will be compared: the project-based and the process-based approach. This will lead to the conclusion that distinguishing between the two perspectives can be a useful theoretical *starting point* for policy analysis.

The *process-based* approach to policy making, -analysis and –evaluation will be applied in this study. This theoretical approach will prove to be capable in providing useful insights, but the approach also implies various limitations.

Firstly, the theoretical *evaluation criteria* are most applicable for outcomes of a *negotiated* process. In the case of the gas roundabout policy process, it will be questionable whether the outcomes of the *platform* were actually negotiated. In addition to that, there are also other interactions of EL&I with the industry. Strictly applying the theoretical criteria may thus result in an incomplete picture. A second limitation of the theory is the existence of other elements which determine e.g. actor-involvement and process-design. These factors can be related to e.g. power and politics, or path-dependent beliefs or insights of the policy makers. It is problematic to include those factors in a theoretical perspective, but yet an important *explanatory power* can

be derived from these elements. The most important limitation of the *process-approach* for this study will be its limited insight on the question whether *some* problems are solved*,* and does not provide guidelines how analysts can determine the *contribution* of the policy to the research domain. These limitations will urge the need to combine the useful policy-analysis theories with other, e.g. economical, theories to provide further insight in both the research domain and the policy.

To improve the theory, go beyond the identified limitations and fill the scientific research gap, the "integrated policy framework" will be developed. This framework is applicable to structure policy-analysis of *wicked problems* in research domains characterized by a *multi-actor* context. The main added value is that is incentivizes policy analyst to address both the regulatory regime – being the policy objectives, instruments, and process – and the research domain, together with the *multi-actor context*. Still, policy analysis remains a *tailored* exercise, as developing a theory or model to determine the contribution of the policy to the research domain is case-specific.

To develop a theory on which assumptions can be made about policy *contribution* to the attractiveness of upstream investments, this study will conduct a sequence of theoretical steps. First, in this study the theoretical guidelines of Ostrom (2005) will be applied to develop the "methodological interactionistic framework" and to identify possible relevant theories: Porter's Five Forces Theory, Transaction Cost Economics and the Resource Based View. The "methodological interactionistic framework" is generally applicable to the specific research domain of upstream investments. Ostrom's general guidelines on developing a theoretical perspective are a useful point of reference, though it lacks insight on *combining* theories. Insights of Groenewegen and Vromen (1996), which addressed theoretical *pluralism*, will prove to be a useful step to develop the "pluralistic theory of the firm". The "pluralistic theory of the firm" successfully compensates for the limitations of the individual three theories, and provides a theoretical perspective which is relevant to *theoretically* determine the contribution of policy to the upstream investment climate. The added value of this theory is its ability to take into account the *methodological interactionistic* nature of the research domain, and *all* relevant elements of the "methodological interactionistic framework." The structured approach to develop a theoretical perspective is based on the combination of both Ostrom's and Groenewegen and Vromen's guidelines. This approach will be subsequently incorporated in the "integrated policy framework" to support future research and policy analysis.

CONCLUSIONS

This study will conclude that the contribution of the gas roundabout policy to the attractiveness of the upstream investment climate is limited. The gas roundabout policy does not actively contribute to the regulatory regime – as the policy comprises a limited fair decision-making process and the objectives and instruments of the policy are mainly *tagged* to the *frame* gas roundabout. The existence of the instruments and objective is independent from the gas roundabout policy. This study will also illustrate that a policy analysis from a *process*-perspective allows to place such conclusions in perspective. For future policy analysis, the "integrated policy framework" will be suggested, as this can support to draw similar conclusions but also stimulates researchers to place those conclusions in the right perspective of the *policy context.* This can enrich the understanding on policy.

The gas roundabout policy actively facilitates investments which can add 121 bcm to the business-as-usual scenario. This is not sufficient to realize the desired 230 bcm, and many residual issues which are overlooked will be identified. Table I summarized these issues, and possible measures to mitigate these issues. This study will illustrate how a structured scientific approach can be developed to draw certain conclusions, and how this approach can enrich policy analysis.

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Appendices 1-10 and the Scientific Article are assembled in the enclosed document

1. INTRODUCTION

1.1 NATURAL GAS IN THE NETHERLANDS

Natural gas plays an important role in the Dutch energy sector and delivers a significant contribution to the wealth and wellbeing of the Dutch society (Correljé, 2011). Both production and per-capita consumption of natural gas in the Netherlands are the largest in Northwest Europe (EUROGAS, 2011), leading to a significant contribution to the Dutch state's revenues of €12 billion in 2011 (Dutch Ministry of Finance, 2011) and direct employment for over 100.000 Dutch citizens (Brattle, 2010:70).

As presented in figure 1 below, the Dutch natural gas system comprises of three interrelated parts: upstream, midstream and downstream, and is characterized as a *multi-actor system*. The upstream part consists of exploration and production (E&P) activities - from natural gas in the reservoir to delivering processed natural gas to the transmission grid of the Dutch transmission system operator (TSO) GTS. The upstream part involves oil companies and private investors, such as NAM, Wintershall, NPN and Dyas. Also many public actors are involved, for example the Dutch ministry of Economic affairs, agriculture and innovation (EL&I) for licensing and regulation, EBN as state-participant, State Supervision on the Mines (SodM) for safety regulation and TNO for research about the Dutch subsurface. The midstream part includes transmission, storage, LNG-terminals, quality conversion and wholesale trade. Import and export of natural gas are other important aspects of the midstream part of the Dutch natural gas system. Involved public actors are investors in storage-facilities such as Taqa, investors in LNG-facilities such as Vopak, and wholesale traders such as GasTerra, RWE and Gazprom. Involved public actors are the TSO GTS, Gasunie as owner of the pipelines, EL&I for regulation of the market and infrastructure, the Dutch antitrust authority (NMa), and the Ministry of Finance as shareholder of state-participant Gasunie. Thirdly, the retail and (local) distribution activities are referred to as downstream, after which the gas is consumed by households or industrial users. Involved actors are distribution system operators (DSOs) such as Enexis and Liander, and utility companies such as Vattenfall and Eneco.

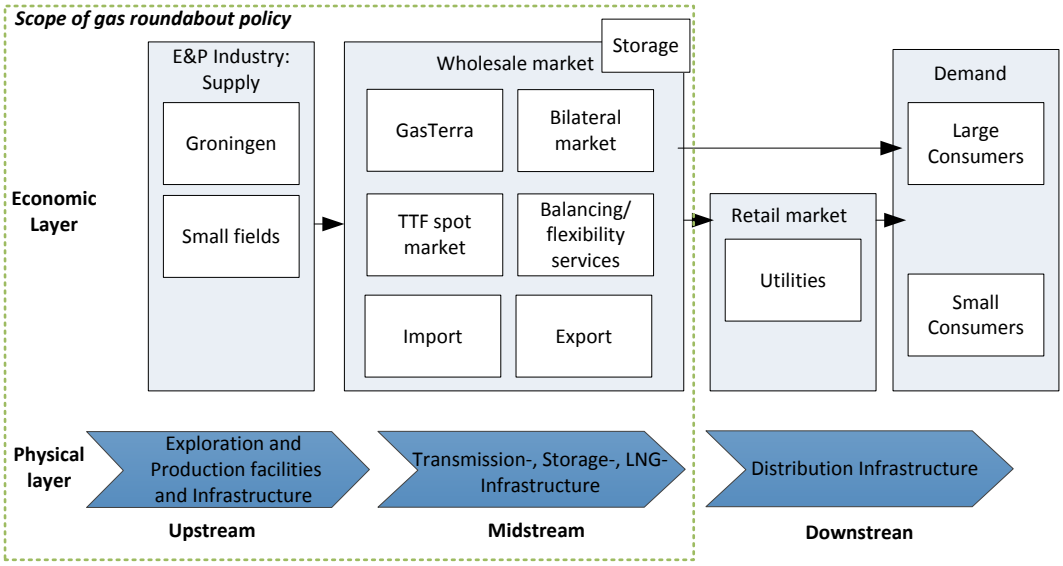


FIGURE 1: DUTCH NATURAL GAS VALUE CHAIN (SOURCE: OWN COMPOSITION ADAPTED FROM DE VRIES, 2010:11)

1.2 GAS ROUNDABOUT AS NEW POSITION OF THE DUTCH NATURAL GAS SYSTEM

Driven by developments as the liberalization-process of the European natural gas systems, the Dutch Energy Council (AER) provided their perspective on the changing Dutch and European natural gas system (the physical and economical layer or value chain) in 2005. They advised the Dutch government to contribute to the European liberalization process, as this would result in long-term security of supply and a competitive European natural gas system with affordable end-user prices. To prosperously position the well-developed and unique Dutch natural gas system within this future European natural gas system, they advised the Dutch government to develop a strategy which could maximally valorize the Dutch competitive advantages: the upstream sector, the extensive midstream infrastructure, the strong position of Dutch natural gas midstream traders (GasTerra), and the available knowledge and expertise (see AER, 2005).

These four competitive advantages were the impetus to position the Dutch natural gas value chain as the *gas roundabout* of Northwest-Europe, where Dutch companies could create economic value and security of supply by producing, trading and transporting natural gas. From out this AER-advice, the subsequent four ministers of EL&I developed the *gas roundabout policy* during the period 2005-2011 (EZ, 2006; EZ, 2008; EZ, 2009; Brattle, 2010; EL&I, 2011): "Because of the Dutch gas resources, infrastructure and expertise, the policy is aimed at valorizing the position as gas country and position the Netherlands as the gas roundabout of Northwest Europe. This must create employment, economic activity and security of supply (EL&I, 2011:3)." EL&I elaborated on the gas roundabout as a strategy where the focus on the Dutch gas value chain will be shifted from mainly production-oriented towards more focus on production, transit, storage, trade and innovation. (EZ, 2006) The gas roundabout policy is aimed to contribute to the upstream investment climate, additional midstream investments in infrastructure, transit capacity, LNG terminals, storage and flexibility. Also, the gas roundabout policy emphasizes on more trade on the TTF spot market, a changing wholesale market structure and market-coupling with other European gas hubs such as the British NBP (EL&I, 2009:14; EL&I, 2011).

To realize the desired position as gas roundabout, investments have to be made by market parties. According to EL&I (2011): "The role of the government is limited to actively contribute to these investments by (i) setting the right regulatory regime and policy, and (ii) facilitate investments by deploying certain policy means." (EL&I, 2011:2) This study is concerned with the contribution of the gas roundabout policy to *upstream* investments.

1.3 GAS ROUNDABOUT POLICY EVALUATED

In 2010, consultants of the Brattle group made an economic impact assessment of the gas roundabout policy to support EL&I in their policy making on the gas roundabout (Brattle, 2010). For upstream investments, Brattle assumed that 15 additional conventional exploration wells will be drilled annually in the gas roundabout scenario, adding 230 billion cubic meters of natural gas (bcm) from small-fields over the period 2010-2030 (Brattle, 2010:64). For midstream investments, Brattle assumed additional investments in transport capacity to accommodate transit streams of natural gas, an additional LNG-terminal, an additional storage facility, and a 30% annual growth rate of TTF trade.

These additional investments, which are conducted by market parties and state-participants such as Gasunie and EBN, would result in the significant contribution to the Dutch economy of more than €21 billion over the period 2010-2020, as summarized in table 1 below.

TABLE 1 ECONOMIC IMPACT OF GAS ROUNDABOUT POLICY 2010-2020 (SOURCE: BRATTLE, 2010)

Sector	Additional Investments (€million)	Economic Impact (€million)
Upstream	€ 4.925	€ 11.093
Midstream (Transport, LNG and Storage)	€ 2644	€ 6099
R&D	€ 1.549	€ 3.418
Trade	€ 225	€ 448
Total	€ **9.343**	€ **21.058**

However, Brattle did not substantiate *how* the gas roundabout policy would contribute to these additional upstream investments. Brattle, and other policy publication of the gas roundabout (EZ, 2009; EZ, 2011) are silent about the causal relations between the policy and the assumed additional investments in upstream exploration and production. As the majority of the economic impact of the overall gas roundabout policy is derived from these additional upstream investments, it is necessary to substantiate the relation between the gas roundabout policy and upstream investments more thoroughly.

In 2012, the Dutch Chamber of Audits (CoA) (Algemene Rekenkamer, 2012) also addressed the gas roundabout policy. The Chamber of Audits heavily criticized the gas roundabout policy. The scope of the study was related to one aspect of the policy: investments by Gasunie in the German transmission infrastructure and by EBN in underground gas storage (UGS) facility Bergermeer. It was concluded that no supporting studies were developed to build the gas roundabout policy on – the gas roundabout was perceived unsubstantiated by the CoA. Also, no alternatives were compared with this policy, which was judged culpable because the policy objectives could also be realized by other means (Algemene Rekenkamer, 2012). No proper *ex ante* cost-benefits analysis was performed, and future developments of the gas market were not incorporated. The report heavily criticized the *failed* investments made by state-participant Gasunie in the German grid. Also the provision of information to the Dutch parliament is lacking, and the public values were not properly incorporated in the investment decisions by the state-participants Gasunie and EBN.

Although the CoA report did not address the contribution of the gas roundabout policy to upstream investments, the contradiction between the two assessments (of Brattle and the CoA) provides a second argument to analyze the contribution of the gas roundabout policy to upstream investments. As is seems, there are different approaches to analyze and evaluate the gas roundabout policy. There is a need to place both reports in perspective, and determine what a relevant approach is to analyze and evaluate the gas roundabout policy, and how the policy contributes to upstream investments.

1.4 COMPANY PROFILE: EBN B.V.

This study is commissioned by EBN B.V., an independent company with EL&I as sole shareholder. EBN is the state-participant in almost all exploration and production activities in the Netherlands. The Mining Act obliges license holders of exploration and production rights to ask EBN to take part in the Agreement of Cooperation (OvS). This OvS determines the distribution of rights and duties between the parties. EBN always has a 40% share in this OvS, which gives EBN the duty to account for 40% of the costs, and gives them the right of ownership of 40% of the produced natural gas. The license holders – mostly consisting of one or more oil companies and investors within a joint-operating agreement (JOA), of which one party is the *operator* – have the rights and duties of the remaining 60%. As EL&I is the sole shareholder of EBN, this institutional structure is an important instrument for the Dutch government to benefit from the natural resources (Roggenkamp, 2007). In 2011, EBN transferred €5.8 billion to the Dutch government (EBN, 2012), accounting for a large share to the total state's revenues from natural gas. In addition to that, EBN is one of the main advising bodies to the Dutch government with regard to the upstream natural gas policy (EBN, 2012).

1.5 THE GAS ROUNDABOUT POLICY AND THE UPSTREAM INVESTMENT CLIMATE

EBN has the ambition to realize an attractive upstream investment climate. Without additional upstream investments, the current level of natural gas production from small-fields will gradually fall to 10 bcm in 2030, as presented in the figure 2 below as the *business as usual* (BAU) scenario (EBN, 2012:9). The potential upside is significant, and could result in a production level of 30 bcm of natural gas in 2030 (also see figure 2). To valorize this potential upstream upside, additional investments are required in exploration activities, extending existing production (tail-end), developing fields which are currently not viable due to economic or technical reasons (stranded fields or contingent resources), and in developing tough resources such as shale-gas or shallow-gas (EBN, 2009).

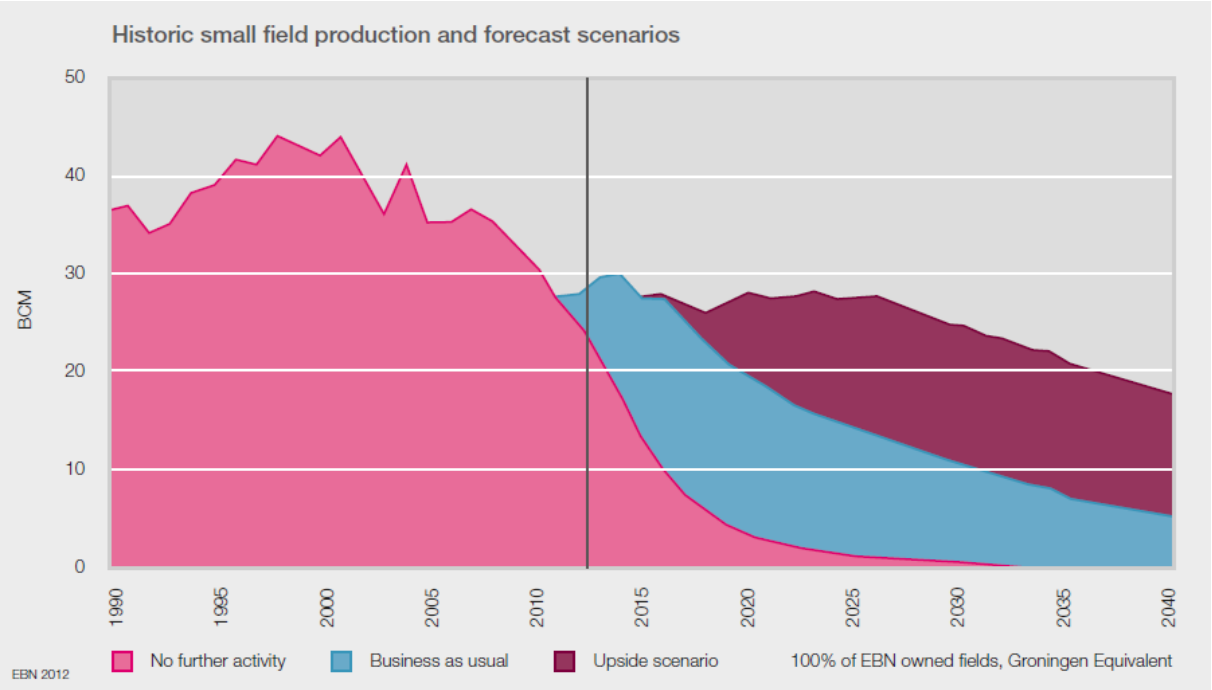


FIGURE 2: HISTORIC SMALL FIELDS PRODUCTION AND FORECASTS (SOURCE EBN, 2012:9)

These additional investments have to be made by market parties, which can be stimulated to invest by an attractive investment climate. EBN estimated that an attractive mining climate, with subsequent investments and efforts by market parties, could add 230 bcm of natural gas production from small-fields in the period 2010-2030. With the current natural gas price, this would result in €46 billion *additional* revenues for the Dutch upstream industry, including EBN and its shareholder EL&I. To realize this upside, EBN estimated that €35 billion of *additional* capital expenditures have to be made by the industry, including EBN, in the same period (EBN, 2010).

Because of its elementary role in the Dutch upstream industry, EBN wants to know the contribution of the gas roundabout policy to the attractiveness of the Dutch upstream investments climate, as this policy has the objective to contribute to this attractiveness. Ideally, the gas roundabout policy contributes to the attractiveness of the upstream investment climate to such an extent that the potential upside of 230 bcm over the period 2010-2030 could be realized. Given the two mentioned policy evaluation studies of Brattle and the CoA, EBN has two elementary questions.

The first question relates to the *content and nature* of the gas roundabout policy. As the CoA stated that the policy was unsubstantiated, EBN wants to know whether this is the case for the aspects of the gas roundabout policy addressing the upstream investment climate. Does the gas roundabout policy actively contribute to the right regulatory regime and policy, as it is suggested to be? How did the gas roundabout policy emerge? How can it be explained that two policy-analysis reports (Brattle, 2010 and CoA, 2012) conclude so differently about the policy? To answer these questions, EBN wants to know how the gas roundabout policy can be analyzed and evaluated.

The second question relates to the contribution of the gas roundabout policy to the attractiveness of the upstream investment climate. EBN wants to know how the assumptions of Brattle and the CoA about the *contribution* of the gas roundabout policy can be substantiated. What are the *contributing factors* (the policy means and intended result of the policy) of the gas roundabout policy to the attractiveness of the upstream investment climate? How do these contributing factors have an impact on the attractiveness of the upstream investment climate? Does the policy actively facilitate investments required to valorize the potential upside of 230 bcm? Also, EBN wants to know how the regulatory regime interacts with the attractiveness of the Dutch upstream investment climate, and vice versa.

1.6 PROBLEM STATEMENT AND RESEARCH OBJECTIVE

The practical problem statement is twofold. Firstly, it is unclear how the gas roundabout policy can best be analyzed and evaluated. There is a need to place the policy in the right perspective, and analyze the policy as such. This must also place the policy analysis perspectives of Brattle and the Chamber of Audits in the right perspective, and explain the contradiction of those two studies. EBN wants to know whether the gas roundabout policy is actively aimed to develop the right regulatory regime in which upstream investments take place. Secondly, it is unsubstantiated to what extent the policy actively facilitates upstream investments. EBN wants to know whether the gas roundabout policy actively facilitates the required investments to realize the 30-30 policy objective, as suggested by the policy publications. Both elements determine the contribution of the gas roundabout policy to the attractiveness of the Dutch upstream investment climate.

The scientific problem statement relates to the situation that it is unclear how the contribution of policy to upstream investments can be analyzed from a theoretical point of view. It is necessary to develop a structured theoretical approach which can be used to analyze the contribution of policy to the upstream investment climate.

The societal objective of this research is to fill the practical knowledge gaps, and with that determine the contribution of the gas roundabout policy to the attractiveness of the Dutch upstream investment climate. This study must result in a set of recommendations to EL&I, which can support future decision-making on the Dutch natural gas system, and in particular on the *gas roundabout* and the upstream part of the natural gas system.

The scientific objective of this research is to contribute to the scientific approaches to policy analysis, and to contribute to the insight how upstream investments can be structurally analyzed in relation to policy.

1.7 RESEARCH QUESTIONS

This study is aimed and structured to answer the following central research question:

What is the contribution of the gas roundabout policy to the attractiveness of the Dutch upstream investment climate?

This will be done in four steps. Firstly, the gas roundabout policy will be described by a preliminary analysis. This will provide a brief and clear overview of what this policy comprises according to policy publications, and what the *contributing factors* are of the gas roundabout policy to the attractiveness of the upstream investment climate. The first research question of this study is:

1. *What is the gas roundabout policy, and what are the contributing factors to the upstream investment climate?*

The second step is to conduct the first PART of this research. It must be determined what the contribution of the gas roundabout policy is to the *regulatory regime* in which upstream investments take place. The regulatory regime is seen as the set of policy objectives, instruments and processes. Research questions:

2. *How can the gas roundabout policy be analyzed and evaluated?*
3. *What is the contribution of the gas roundabout policy to the regulatory regime in which upstream investments take place?*

The third step of this research is to conduct the second PART of this research. This part must determine the contribution of the gas roundabout policy to the attractiveness of the upstream investment climate. Research questions:

4. *How can the contribution of the gas roundabout policy to the attractiveness of the Dutch upstream investment climate be analyzed?*
5. *What is the contribution of the gas roundabout policy to facilitating upstream investments?*

The third PART will provide a synthesis of the two previous PARTs, and emphasize on the interaction of the two previous PARTs and answer the main research question. Also, the practical and scientific knowledge gap will be filled. Research questions:

6. *How do the regulatory regime and the ability of the gas roundabout to facilitate investments interact?*
7. *What is the contribution of the gas roundabout policy to the attractiveness of the Dutch upstream investment climate? (main research question)*
8. *How can the gas roundabout policy be amended to more actively contribute to the attractiveness of the Dutch upstream investment climate?*

1.8 RESEARCH OUTLINE AND METHODOLOGY

Figure 3 below graphically presents the structure of this research. It describes the four identified steps, segmented in theoretical-, empirical- and synthesis chapters.

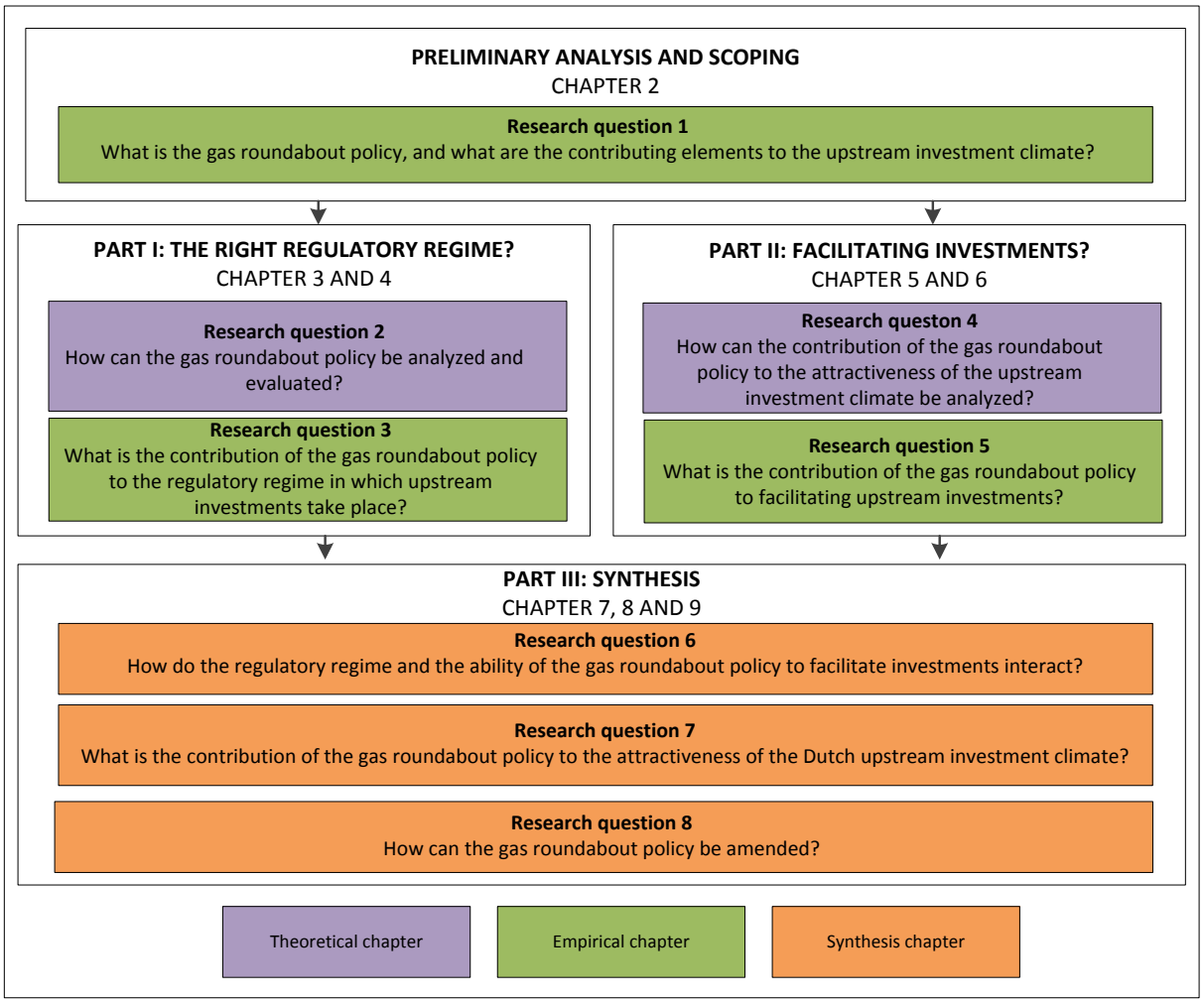


FIGURE 3: STRUCTURE AND OUTLINE OF THE RESEARCH

Chapter 2 will first briefly describe the gas roundabout policy in terms of the policy objectives and the policy instruments. It is important to determine how this study approaches the gas roundabout policy, in terms of scope and its contributing factors. This description forms the starting point to develop theoretical frameworks, and apply these in subsequent phases of research. A desk-study will be performed in order to explicate the policy, based on a review of the policy publications and other literature. This chapter will answer the first research question in a descriptive method.

PART I: THE RIGHT REGULATORY REGIME?

The first part of this research will attempt to examine the contribution of the gas roundabout policy to the regulatory regime. Chapter 3 will answer research question 2, by describing possible approaches to policy analysis and evaluation. A theoretical desk-study was performed for this section. Chapter 4 will answer the third research question by applying the identified theoretical body. The contribution of the gas roundabout policy to the regulatory regime will be determined, based on an empirical desk-study and multiple interviews with involved policy makers of EL&I.

PART II: FACILITATING INVESTMENTS?

The second part of this research aims to determine the extent to which the policy actively facilitates upstream investments, and with that contributes to the attractiveness of the upstream investment climate. Chapter 5 will develop a theoretical body which can be used to analyze the contribution of policy to the attractiveness of upstream investments. This theory has to make precise assumptions about the nature of upstream investments, and the role of policy. An extensive theoretical desk-study was conducted to answer the fourth research question in that section. Chapter 6 will answer the fifth research question by applying this developed theory. An empirical desk-study was performed, comprising a literature-study and other analyses. Required empirical insights were gathered by conducting interviews with 6 different oil firms – the actors who have to invest – and interviews with EBN and GasTerra (see appendix 10 for an overview of conducted interviews).

PART III: SYNTHESIS

The third part of this study will combine insights from the two previous parts. Chapter 7 will emphasize on the interaction between the two parts – the regulatory regime (part I) and the facilitation of upstream investments (part II). Thereafter, the main research question of this research will be answered in chapter 8. This chapter can be seen as the concluding part of this study. The last chapter will provide recommendations to amend the gas roundabout policy. Finally, a reflection chapter is included.

1.9 RESEARCH SCOPE

This study is limited to analyze the contribution of the gas roundabout policy to the attractiveness of upstream investments in small-fields in the Netherlands, addressing two important criteria from out two different perspectives, elementary to determine the contribution of the gas roundabout policy to the attractiveness of the Dutch upstream investment climate. As the Dutch natural gas system comprises of many elements (see figure 1) it is necessary to clearly delineate the scope of this study.

Firstly, although the Groningen field produces the majority of the natural gas in the Netherlands – an annual 50 bcm, compared to an annual 30 bcm from small-fields – this study will not address the Groningen field because the gas roundabout policy is not aimed at Groningen-field production. In addition to that, the declining production level of the Groningen field is inevitable, and it is assumed in this study that investments in small-fields are independent of the Groningen field, as also implicitly assumed by EBN (EBN, 2011; EBN, 2012). Moreover, the different gas qualities from small-fields and the Groningen field will not be addressed in this study.

Secondly, this study is also limited to the upstream part of the Dutch natural gas value chain. Physically, the scope of this study is from natural gas in the subsurface to the point that the produced natural gas is injected in the transmission grid of GTS. Economically and institutionally, the scope of this study is from establishing a governance structure for E&P activities, to selling the natural gas to the wholesale market. Although the gas roundabout policy is also aimed at contributing to midstream investments, this study will not extensively address the precise contribution of the gas roundabout policy to investments in midstream infrastructure (see De Vries, 2010), or the development of the wholesale market. Because these midstream elements are important to consider – as it e.g. determines the sales of produced natural gas for the upstream parties – developments in the midstream part of the value chain as result of the gas roundabout policy will be assumed as *independent variables* (also see chapter 2). This research is aimed at The Netherlands, within the global E&P context.

2. PRELIMINARY ANALYSIS AND SCOPING OF THE GAS ROUNDABOUT POLICY

In order to answer the research question:

What is the gas roundabout policy, and what are the contributing factors to the upstream investment climate?

This chapter will briefly describe the gas roundabout policy, based on policy publication, and will describe how it is related to upstream investments. The objectives and instruments of the gas roundabout policy will be described to give an idea what the policy comprises (2.1). Thereafter, the direct contributing factors will be identified. (2.2). Chapter 2.3 will identify the indirect contributing factors. Chapter 2.4 will conclude and describe how the gas roundabout policy is scoped for the remainder of this research.

2.1 THE GAS ROUNDABOUT POLICY IN BRIEF

As mentioned in the introduction, the gas roundabout policy is aimed at two objectives (EZ, 2009; EZ, 2011). Firstly, secure supplies of natural gas on a European and national scale by establishment of a strong European gas market with a diversified gas mix. This is aimed for by maximizing the production of Dutch resources, maximize the integration with other European gas infrastructures and markets, and contribute to European geopolitical efforts (EZ, 2011). Secondly, the gas roundabout policy is aimed to maximize the economic value of the Dutch natural gas industry by valorizing the competitive advantages of the Dutch geology, geography, infrastructure, knowledge, and well-developed market. This is aimed for by maximize the production of Dutch resources, maximize gas streams to the Netherlands to meet indigenous demand and to add-value for the Dutch economy by facilitate investments by national and foreign parties in the Dutch gas industry, market and infrastructure, and by enabling a strong and innovative gas industry. Figure 4 below indicates the objectives and instruments of the policy according to the most recent policy publication (EL&I, 2011).

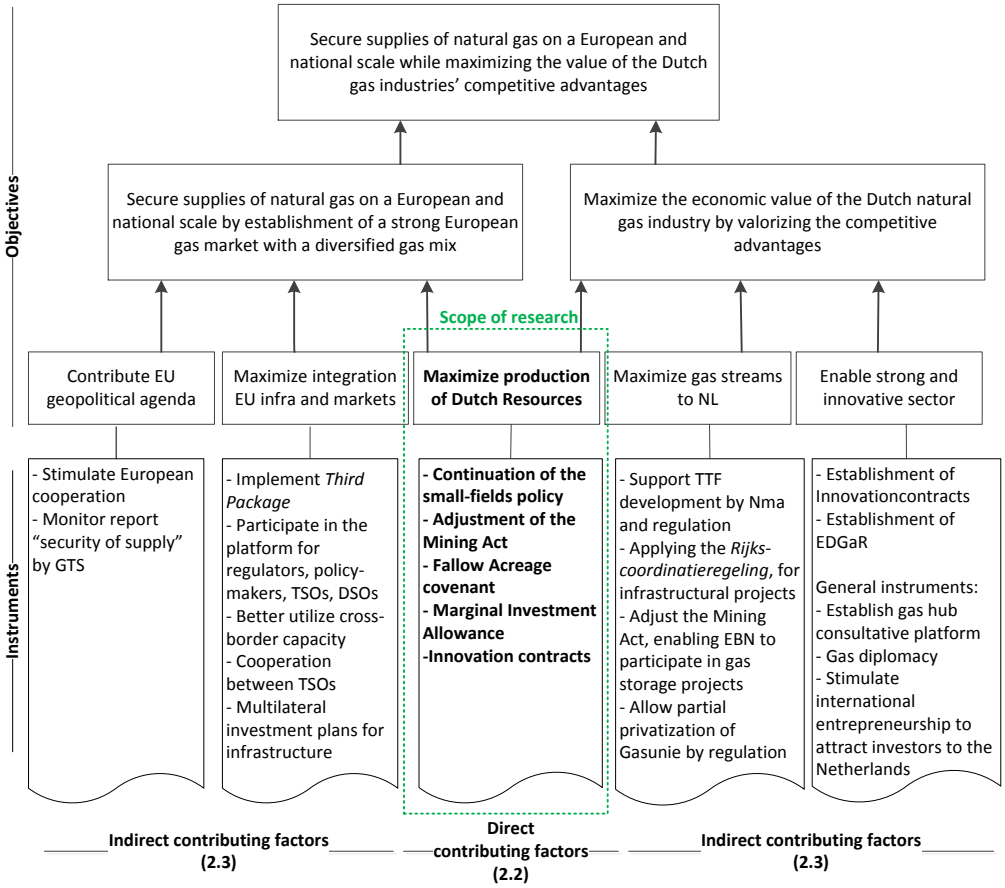


FIGURE 4: OBJECTIVES AND INSTRUMENTS OF THE GAS ROUNDABOUT POLICY, BASED ON EZ, 2009; EL&I, 2011

In brief, the gas roundabout policy is an official policy aimed to re-position the Dutch natural gas system. As indicated in policy publications, "the gas roundabout is no physical asset and has no owner." (EL&I, 2011) The gas roundabout is a *metaphor* for a desired situation of the entire Dutch natural gas system, and the policy comprises a large set of policy instruments, initiatives and objectives as presented in figure 4.

The remainder of this research will be focuses on the objective to maximize the production of Dutch resources. However, this objective is interrelated with the other objectives as midstream developments might have an impact on the sales of the produced natural gas. This *indirect* contribution of the gas roundabout policy will be investigated in paragraph 2.3. The next section will briefly describe the gas roundabout policy instruments which are aimed to *directly* contribute to the attractiveness of the Dutch upstream investment climate.

2.2 DIRECT CONTRIBUTING FACTORS OF THE GAS ROUNDABOUT POLICY

As figure 4 pointed out, the gas roundabout policy has five measures which are directly aimed to facilitate upstream investments, and with that contribute to the attractiveness of the upstream investment climate. These measures will be briefly described below.

2.2.1 CONTINUATION OF THE SMALL FIELDS POLICY

The gas roundabout policy states that the *continuation* of the small-fields policy (SFP) is an important policy instrument of the gas roundabout policy to contribute to the attractiveness of the upstream investment climate (EZ, 2011:17). The SFP was established after the oil crisis in the 70s with the aim to give other fields than Groningen preferential treatment (Mulder and Zwart, 2006:24). This policy was, and is, effective in raising production from small onshore and offshore fields which otherwise may have been uneconomic for producers (see Peebles et al., 1999; Roggenkamp, 2007).

There are multiple interpretations what the SFP exactly comprise, and how it is related to other *institutional structures* governing upstream natural gas. Some argue that all measures aimed at non-Groningen fields are part of the SFP, and all measures aimed at the Groningen-field are part of the "Gasgebouw". Others argue differently. In order to make a clear distinction, this research delineates the SFP in relation with other institutional structures according to Roggenkamp (2007):

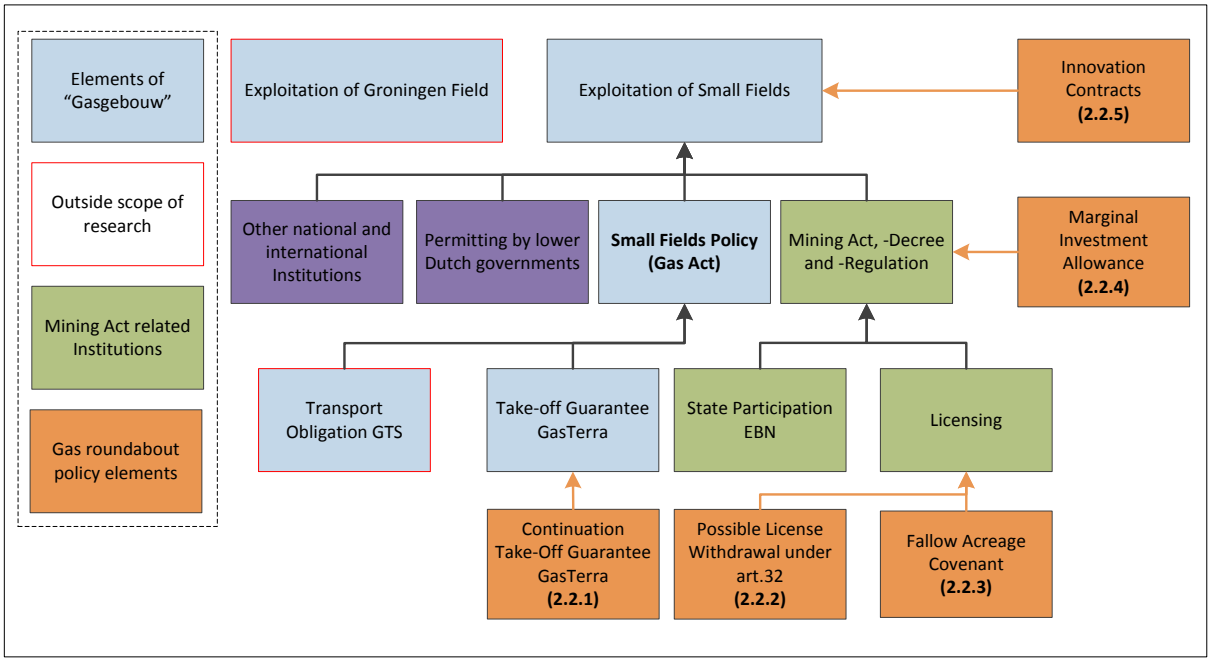


FIGURE 5: THE "GASGEBOUW" AND SMALL-FIELDS-POLICY AS SCOPED FOR THIS RESEARCH (ADAPTED FROM ROGGENKAMP, 2007)

According to Roggenkamp (2007), the SFP consists of the off-take guarantee of GasTerra, as formalized in the Gas Act (art.54). This provision obliges GasTerra to buy all produced natural gas from small fields at *market conform* conditions (Roggenkamp, 2007:35). This lowers the volume risk for producers and gives a certain degree of certainty about the price. Also, the SFP obliges the TSO (GTS) to accommodate the produced natural gas from small fields, which reduces the midstream infrastructural uncertainty (EBN, 2012:27). As mentioned in 1.9, this research will not address midstream transmission transport by GTS.

Together with the SFP (formalized in the *Gas Act*), exploration and production of small-fields is governed by the following *formal institutions*:

- The *Mining Act, -decree and –regulation*. These elements comprise licensing by EL&I, state-participation of EBN, and specific taxation-measures (also see next section);
- Permitting by lower governments (provinces and municipalities), related to e.g. spatial planning;
- Other international institutions such as European Antitrust and national institutions such as the general fiscal regime (VpB) or environmental institutions.

In line with Roggenkamp (2007), the "Gasgebouw" therefore comprises all measures aimed at the exploitation of the Groningen-field (which will not be addressed in this study) and the SFP.

Figure 5 also illustrates how the direct *gas roundabout policy* instruments relate to the formal institutions governing the exploitation of small-fields. Continuation of the SFP will be seen as a continuation of GasTerra's off-take guarantee. Adjustment of the Mining Act, Fallow Acreage, and the Marginal Investment Allowance – all presented as instruments of the gas roundabout policy – relate to the Mining-act elements of the institutional structure. The remainder of this research will be based on this scope.

Historically, the "Gasgebouw" as institutional structure gave the Dutch government possibilities for intervention in the natural gas value chain. Before the liberalization and unbundling of Gasunie, upstream investments were stimulated by adjusting midstream structures (see Roggenkamp, 2007; Mulder and Zwart, 2006). The currently unbundled "Gasgebouw" is perceived as illustrated in figure 5.

2.2.2 Adjustment of the Mining Act

All activities concerning exploration and production are regulated by the Mining Act. The Mining Act, and the subsequent Mining Decree and Mining Regulation, determine to which requirements an applicant of an exploration or production license must subscribe, which procedures are applicable and under which conditions a license will be granted. Depending on the location and circumstances of the intended exploration and production activity, additional permits can be required based on national, provincial or municipal requirements (see NLOG). The most important aspects of the Mining Act concern the following:

- A 40% state participation of EBN in the exploration and production activities by means of an obligatory agreement of cooperation (OvS) (art. 2);
- Taxes paid to the Dutch state by the license holder. These taxes comprise the corporation tax (VpB) and the state-profit-share (SPS) (EBN, 2012:30) (art.5);
- Rights and duties of the license holder, and the Dutch state by means of EBN, written in the OvS (art.3 and art.7);
- Control and enforcement of the license and operations by EL&I and EBN (art. 4 and art.8);

EL&I has the authority to actually grant a license for exploration and production activities to the applicant of the license. In this procedure, the minister is advised by TNO about the technical effects on the subsurface, State Control on the Mines (SodM) about the health-, safety- and environmental effects, and by EBN about the operational and economic effects of the license and license applicant. Together with the Gas Act, Environment Protection Act, the Spatial Planning Act and the Flora and Fauna Act, the Mining Act forms the set of formal institutions which govern the natural gas value chain.

Stated as instrument of the gas roundabout policy, the Mining Act was adjusted in 2009 (EZ, 2009; EZ, 2011). A new provision was included (art.32) stating that when a license holder does not show significant activity over

the past two years, the minister of EL&I can reduce the licenses area. A new acreage (with sufficient size according to art.11) can be licensed to other applicants. This has the aim to stimulate an active usage of the license.

2.2.3 FALLOW ACREAGE

In respond to that adjustment of the Mining Act, a new institutional arrangement was signed between EL&I and all operators: the fallow acreage covenant (NOGEPA, 2009). This covenant, a non-binding agreement, which allows license holders to voluntarily declare a part of the licensed acreage *fellow*, making it available for other applicant of licenses to perform exploration or production activities on that particular acreage (EBN, 2012:27). This covenant is stated as important gas roundabout policy instrument, aimed at stimulating a more active usage of the license area.

2.2.4 MARGINAL INVESTMENT ALLOWANCE

An additional fiscal incentive for exploring and producing small marginal fields was adopted in 2010. This fiscal instrument allows producers of certain off-shore marginal fields to subtract 25% of their capital investments over which SPS must be paid. This gas roundabout policy instrument is aimed to develop sub-economical reserves, which may become viable with this measure, and to reduce the burden of a dry-hole exploration drilling for the license holder (see EBN, 2012)

2.2.5 INNOVATION CONTRACTS

Innovation and research and development (R&D) are stimulated by the Dutch government. This is done by a fiscal incentive, which makes it possible to subtract 40% of the R&D expenses of the revenues which are exposed to corporation tax. Moreover, joint-industry projects and R&D are stimulated by 'innovation contracts' (EBN, 2012:34). This program is established for fundamental and applied R&D for new upstream technologies, together with several knowledge institutes (e.g. TU Delft, EDGaR). These innovation contracts are the last instrument of the gas roundabout policy to contribute to the attractiveness of the upstream investment climate.

2.3 INDIRECT CONTRIBUTING FACTORS OF THE GAS ROUNDABOUT POLICY

As mentioned in figure 4, the gas roundabout policy is also aimed to contribute to other elements of the Dutch natural gas value chain. The policy objectives to contribute to attracting gas streams to the Netherlands, and to contribute to the integration of European infrastructure and markets can have an indirect contribution to the attractiveness of the upstream investment climate as this changes the midstream part of the natural gas system on two interrelated layers: the development of a physical gas hub (2.3.1), and the development of a virtual gas hub (2.3.2). The contribution of the gas roundabout policy to these two layers will be described below, and it will be determined which elements are relevant to take into account in the remainder of this research.

Apart from the gas roundabout policy, there are also other developments which contribute to the development of a physical- and virtual gas hub. Examples are the liberalization, or the emergence of the global LNG market (see Spanjer, 2008; Haase, 2009; Reuster, 2010, Stern, 2009; Heather, 2012). Therefore, it is necessary to separate the contribution of the gas roundabout policy from these other developments. As these developments are all interrelated, this separation is rather problematic. Because the scope of this thesis is related to the contribution of the gas roundabout policy to upstream investments, this dilemma will be simplified. It will be assumed that all contributions of the gas roundabout policy to the development of the physical- and virtual hub are *solely* dependent on this presence of the gas roundabout policy. Future research is required to substantiate this assumption. It can for example be addressed what 'the contribution is of the gas roundabout policy to the development of the virtual hub, relatively to the liberalization' in future research. The assumptions will be clarified in the two chapters below.

2.3.1 PHYSICAL GAS HUB

The gas roundabout policy is aimed to contribute to the development of a physical *gas hub*. In this desired physical gas hub, demand for gas transit across the Netherlands will, via open seasons (GTS, 2010), be translated into substantial investments in gas pipeline infrastructure. Also, investments associated with the gas roundabout policy will result in an increasing import and export of LNG to the rest of Europe, and will result in the development of multiple gas storage projects. The development of pipelines, LNG-infrastructure and gas storages must result in security of supply, flexibility and facilitates a liquid hub-based gas trading (EZ, 2009). The table below lists the policy instruments and assumed result of these instruments (based on Brattle, 2010; EZ, 2011) for this research:

TABLE 2: CONTRIBUTION OF GAS ROUNDABOUT POLICY TO DEVELOPMENT OF THE PHYSICAL GAS HUB

Development of a physical gas hub (Brattle, 2010:14) (EZ, 2011)			
Midstream element	Pipelines	Storage	LNG
Policy instruments	Tariffs Gasunie	Regulatory measures Adjustment Mining Act. Allow exemptions on rTPA	Regulatory measures. Allow exemptions on rTPA
Results of policy instruments (investments by market parties midstream)	Additional pipeline investments and intra-connectivity Additional transit flows and transport capacity	One additional gas storage facility comparable to Bergermeer	One additional LNG facility in Eemshaven

2.3.2 VIRTUAL GAS HUB

Besides the desired future *physical* structure of the Dutch natural gas market, as elaborated above, the gas roundabout policy is also aimed to change the *virtual* (or economic) structure of the Dutch natural gas market (EZ, 2009; Brattle, 2010; EZ, 2011). As with the development of the physical gas hub, this research assumes that this development will mature and that this development is *solely* caused by the gas roundabout policy. Additional investments in infrastructures and diversification of supplies do not only contribute to security of supply, but can also offset more and different modes of trade in natural gas (IEA, 2008). The gas roundabout policy is expected to facilitate a large and stable spot market that coordinates economic behavior, and will be liquid enough for firms to sink high fixed costs investment based on reliable investment signals (see Hauteclocque, 2009; EZ, 2009; EZ, 2012). This change in economic midstream structure will be operationalized below by briefly addressing the assumed changes in the most important characteristics of the natural gas market: trading mechanism, price indexation, price volatility, market liquidity, contract duration, supply conditions and offered services.

TRADING MECHANISM: ALTERNATIVES TO LONG-TERM CONTRACTING

Gas production requires significant investments in specific assets with long lead times. Initially, sales of natural gas was based on bilateral long-term contracts between the producer of the natural gas and the buyers (e.g. utility companies) in order to minimize risk of these investments for the investors in production activities (IEA, 2008; Frisch, 2010). Apart from bilateral long-term trading, natural gas can also be traded in three other modes: brokerage, auctioning and spot market trading (Correljé, 2010:36). Brokerage is a more advanced form of bilateral trading, where brokers aggregate demand and supply. Auctioning is a process of selling the natural gas to the highest bidder, typically used when there is one party that dominates supply and demand. A spot market is a market point where traders and brokers interact. Spot market trading can be either over-the-counter (OTC), where trading is based on bilateral contracts without necessarily standardizing contracts or publicizing prices, or based on exchange trading, which is done anonymously with standardized contracts and where price is determined by supply and demand.

The gas roundabout policy is aimed at the development of a spot-market as leading trade mechanism (EZ, 2009). This does not imply that bilateral long-term contracts are abandoned, as bilateral contracts can also be traded on the virtual hub (TTF). In order to make a sufficient return on their investments, upstream investors want to have long-term certainty on the one hand, and want to realize a maximum of profits from the

produced gas on the other hand. The development of a spot market gives them an alternative to the conventional long-term bilateral contracts. Depending on the risk-appetite, strategy, and resources and capabilities (e.g. the presence of a commercial department) a producer can decide upon the desired type of trading. CIEP (2008) underlines the widely accepted expectation that long-term contracts will continue to play a significant role in the import portfolio of Europe, for reasons of security of supply and -demand (investment security). Ultimately, it is assumed that spot markets may eventually cover some 25% of the physical market in the scope of this study (based on CIEP, 2008:7), complementing the remaining 75% of bilateral (e.g. OTC) trading.

PRICE MECHANISM: ABANDONMENT OF THE OIL-INDEXATION

In the former midstream structure, the price of a long term contract between a producer and a buyer is based on a so-called *index* or *price-formula*. This price formula consists of several variables, which determine the price (see Konoplyanik, 2010 for examples). Linking the price to substitute fuels originates from the Dutch *market value principle* (Correljé and Odell, 2000). This means that the price of gas was linked to the price of the alternative fuels for consumers (mostly oil-products or coal), so that the consumers would never have to pay more (but also not less) for gas than for competing fuels (IEA, 2008:11). This systematic is referred to as the *oil-indexation* of natural gas. Pricing formulas do not offer the seller or the buyer any insight into the supply-demand balance of the market, neither in the short term or the long term. They are not meant to provide signals or economic incentives to invest in new production assets (CIEP, 2008:11). Price formulates with oil-index are aimed to establish a price which gives both the producer and buyer sufficient certainty to make return on their investments and to sell their gas to end-users.

The gas roundabout policy is assumed to have two effects on the pricing mechanism of natural gas (based on Stern, 2009; Rogers and Stern, 2011, Heather, 2012; Konoplyanik, 2010 who address the effect of hub-based pricing). Firstly, producers can decide to sell a certain amount of natural gas directly to the spot market (25% of the total produced volume in this study). On the exchange, the price is based on so called *gas-to-gas* competition. Gas-to-gas pricing is the price of the natural gas based on actual supply and demand. The second effect of the development of a virtual gas hub on the pricing mechanism is related to the *price indexation* of bi-lateral long-term contracts. Producers who decide on a bilateral long-term contract can also include the average gas-to-gas price on a hub as part of the price-formula. For example (see Konoplyanik, 2010; Frisch, 2010; Davoust, 2008; Melling, 2010 for more):

$$p = P0 + \alpha * O1 + \beta * O2 + \gamma * O3 + \delta C + \varepsilon NBP + \epsilon TTF + \theta ZEE$$

P0 is a bottom price, O1-O3 are the prices of substitute fuels (e.g. light or crude oil), and the variables NBP, TTF and ZEE correspond to the average gas-to-gas price on three trading hubs (notably the British NBP, the Dutch TTF and the Belgian Zeebruge).

The development of European gas hubs has resulted in a shift of these price formulas over the recent years. Where the price formula in the former market structure merely contained substitute fuels, the average price formula for long-term bilateral contracts in 2010 also contained gas-to-gas indexes (Konoplyanik, 2010). The figure 5 below illustrated the effects of gas hubs on the price formula for bilateral long-term contracts.

Some expect that on the long term, the price-formula of long-term bi-lateral contracts will contain merely gas-to-gas indices (Stern,2009; Rogers and Stern, 2011, Heather, 2012). CIEP (2008) argues that spot price information could provide additional guidance for investments, as this economic theory applies to most goods and services. However, the forward curve on traded markets is generally not long enough to fulfill such a role for the significant specific investments (CIEP, 2008:12). On the other hand, using average spot prices in pricing formulas of long-term contracts would largely remove the expected benefit of supplying gas at market-reflective prices, signaling scarcity and abundance (CIEP, 2008:11). In this research, it will be assumed that the gas roundabout policy will result in bilateral long-term contracts which are completely *gas-to-gas* indexed, as desired in the publications (EZ, 2009) and expected by interviewed parties.

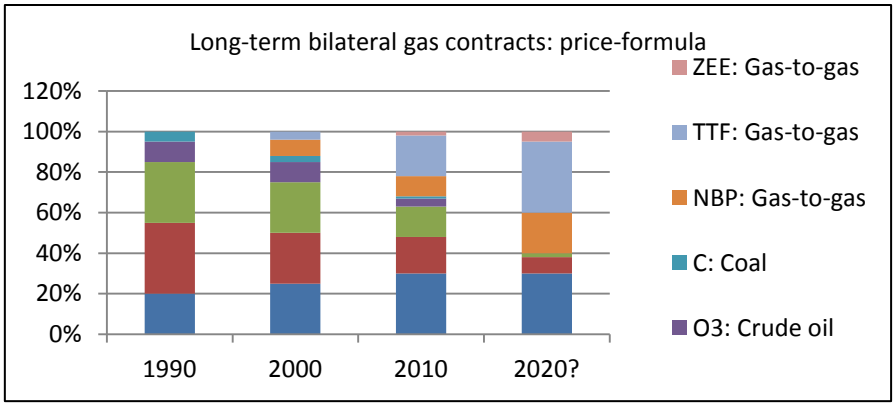


FIGURE 5: PRICE FORMULAS FOR LONG-TERM BILATERAL CONTRACTS OF A DUTCH SMALL-FIELDS PRODUCER WITH A MIDSTREAM BUYER (SOURCE: OWN COMPOSITION BASED ON KONOPLYANIK, 2010)

MARKET INDICATORS: VOLUME, LIQUIDITY AND VOLATILITY

CIEP (2008) indicates that the fundamental characteristics of a functioning market are the volume, liquidity, volatility, contract duration, transparency and acceptability of the market system (also see Juris, 1998). This provides signals for short-term commercial trading and long-term investments in production assets (CIEP, 2008:4).

The first indicator is the total volume of natural gas traded on an exchange. As the figure 6 below indicates, the volume growth of European hubs increased significantly in the period 2003-2007.

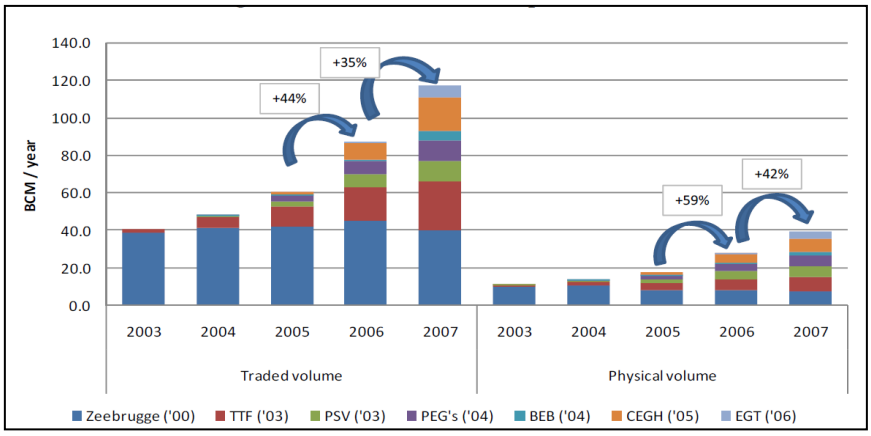


FIGURE 6: TRADED VOLUMES ON EUROPEAN HUBS (SOURCE: IEA, 2008: 51)

The TTF covered 25% of the physical market of Dutch traded natural gas in 2005, and almost all natural gas in 2011 (NMa, 2012). In 2011, 94% of the TTF-traded natural gas was traded OTC (bilateral on TTF), 2% on the exchange of the TTF (APX ENDEX) and 4% classical bilateral on the TTF. Also, 21% was traded in year contracts, 19% on season contracts, 23% on quarterly contracts, 31% monthly contracts, and only 6% week or day contracts. (NMa, 2012:8). This study assumes that the gas roundabout policy will result in a situation where all natural gas is sold to the TTF, 75% of the natural gas is traded OTC, and 25% of the natural gas is traded on the exchange (APX-ENDEX).

A second indicator for market performance is the liquidity of a trading platform. As liquidity increases, so does the ability of the market to efficiently balance supply and demand (Heather, 2012:3). An indicator for liquidity is the churn rate, expressed by dividing the total traded volume by the net traded (delivered) volume for a specific time period (Heather, 2012:32), see figure 7 below. This study assumes that the liquidity of the TTF will, as desired by the gas roundabout policy, further develop into one of Europe's most liquid trading platforms.

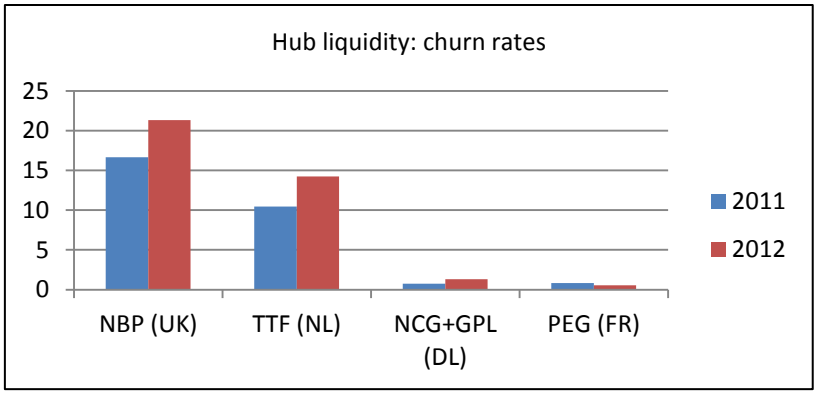


FIGURE 7: LIQUIDITY ON EUROPE'S MAIN SPOT MARKETS (SOURCE: OWN COMPOSITION, BASED ON ICIS HEEREN DATA AND HEATHER, 2012A)

Long-term bi-lateral contracts result in long-term stable flows of revenues, as the price-formula is adjusted only regularly. The figure 8 below indicates the difference in volatility between long-term oil-indexed prices and gas-to-gas prices on the NBP, which is perceived as the most liquid and deep spot market of Europe:

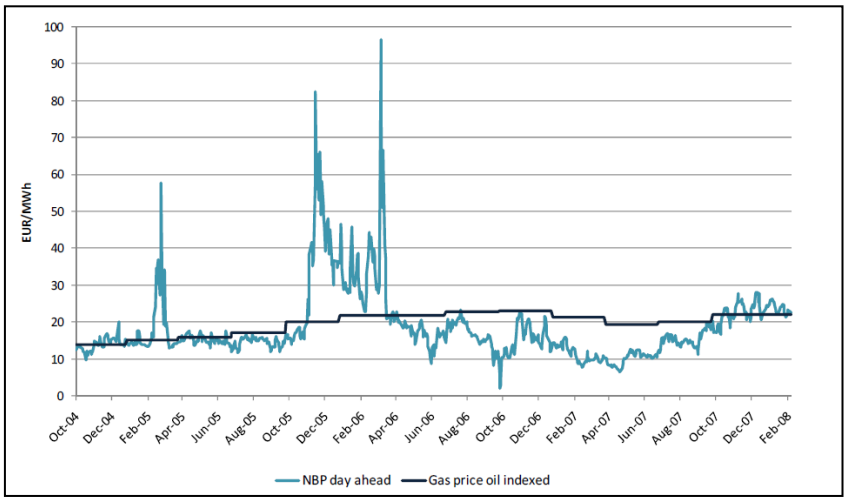


FIGURE 8: PRICE VOLATILITY NBP DAY AHEAD (SPOT MARKET) AND LONG-TERM OIL-INDEXED PRICE (IEA, 2008: 44)

Alterman (2012) has performed an empirical analysis to compare the difference in volatility between natural gas and oil. He concludes that natural gas price volatility substantially exceeds that of crude oil, on average by a factor of 1.5 (Alterman, 2012:40). This was caused by structural differences (storage and transportability) and different consumption patterns. This was also addressed qualitatively by CIEP (2008). Empirical research on the development of the US Henry Hub and the NBP pointed out that volatility does not diminish once the liquidity of the traded market is developing (CIEP, 2008:11). The prices of natural gas on a hub reflect the actual value of the commodity, explaining why the prices are higher in the winter compared to the summer when demand is lower. Moreover, gas is much harder to store than other commodities (e.g. oil, coal) (CIEP, 2008:11).

DURATION OF LONG-TERM CONTRACT

Long term contracts were mostly characterized by a duration which is necessary to recover upstream investments, involving tens of years. A popular duration for long-term contracts in the Netherlands was even related to the life-time of the fields: depletion contracts (see Correljé et al, 2003).

Neuman and Hirschhausen (2004) have examined the effect of the liberalization on the duration of long-term take-or-pay contracts between producers and buyers. It was found that the contract length of take-or-pay gas supply contracts to Europe has significantly decreased over the past decades (see figure 9), and that this is probably because of the move towards liberalization in the EU. The country of origin of the gas affects contract length, as does the additional option of LNG import facilities. They conclude that whereas long-term gas contracts will remain important in Europe, their nature is going to evolve significantly (Neuman and Hirschhausen, 2004:175).

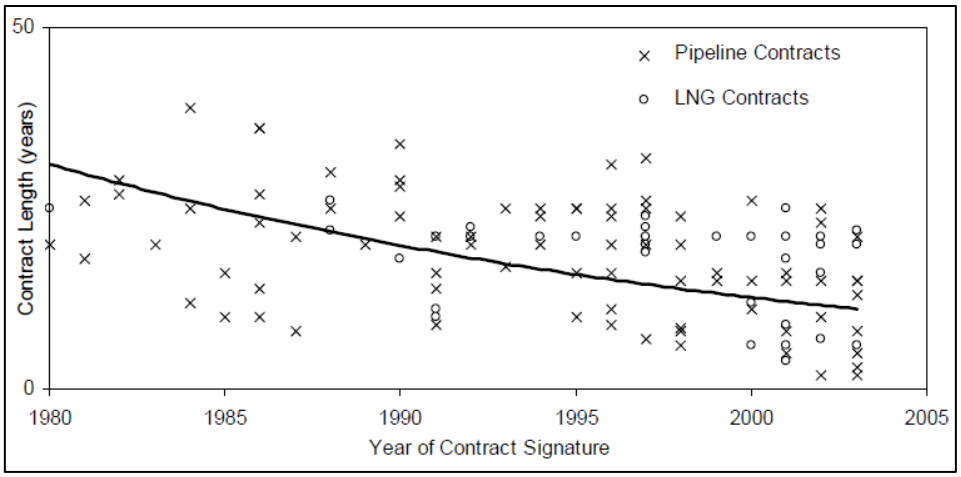


FIGURE 9: AVERAGE CONTRACT DURATION OF LONG-TERM BILATERAL CONTRACTS (NEUMAN AND HIRSCHHAUSEN, 2004:181)

Neuhoff and Hirschhausen (2005) agree with the above conclusions. They applied an econometric model to investigate the economics of long-term gas contracts in Europe: "Producers have a strategic incentive to engage in long-term contracts if long-run price elasticity of demand is significant higher than the short-run demand elasticity (as is the current case). It is concluded that long-term contracts will remain an important element of the European natural gas industry." (Neuhof and Hirschhausen, 2005:18). In addition to that, Neumann and Hirschhausen (2006) have empirically investigated the effect of asset specificity on the duration of natural gas contracts between producers and buyers, in a liberalizing gas market. They found that contract durations decreases as the market structure of the industry develops towards more competitive regimes, and that contracts which are linked to an asset specific investment are on average four years longer than those who are not. (Neumann and Hirschhausen, 2006:2) This research assumes that the gas roundabout policy results in more competitive regimes, and further reduces the contract duration of long-term bilateral contracts.

SUPPLY CONDITIONS

In the former market structure, there were four important contractual conditions. Firstly, as the volume of the produced gas can change over time (e.g. due to operational disruptions or maintenance) the producer of natural gas agrees upon a certain supply volume with the producer. This volume can be agreed upon on a daily base (daily contracted quantity, DCQ), or other bases (weekly contracted base WCQ, annual contracted base ACQ, etc.). The producer is obliged to deliver a certain bandwidth of this contracted quantity (e.g. +/- 10% on DCQ and +/- 0.01% on ACQ), or otherwise a penalty has to paid to the buyer to compensate him for potential damage. Secondly, the producer has take-or-pay liabilities. As the demand for natural gas fluctuates, the producer needs a certain amount of certainty that his produced gas can be taken by the buyer. For example, a take-or-pay clause contains a 90% take-or-pay liability. This gives certainty to the producer that he will pay for 90% of the delivered gas, independent on his actual physical demand. Thirdly, destination clauses were incorporated in long-term contracts to prevent the possible buyer's power to resell the gas to other regions, where gas prices are higher. Fourthly, during the contracting period, the price-formula can be adjusted to new prices of substitute fuels (adjust the existing parameters) or re-negotiated for other reasons (adjust the pricing formula or take-or-pay liability, caused by e.g. market circumstances).

Destination clauses were abolished before the gas roundabout policy was introduced and will not be further addressed in this study. Take-or-pay liabilities and DCQ liabilities will persist in the market structure as gas roundabout, even though Creti and Villenueve (2004) foresee that take-or-pay liabilities will be abolished when mature markets are developed.

OFFERED SERVICES ON HUBS

Correlje (2010) describes that the development of a spot market is typically followed by the development of risk management instruments. Because spot market prices reflect the systems short-run marginal costs of gas

and the opportunity costs of capacity, they tend to be volatile, and the inherent price risk is often very high for many market participants. This leads to demand for risk diversification and, ultimately, to the development of a financial gas market where risk-minimizing financial instruments are traded. These markets can be organized or not, depending on the ability of institutions to respond to market needs. Initially, financial institutions offered mostly swaps to customers on an individual basis (Correlje, 2010:36). The development of a hub-based market therefore gives more transparent and organized possibilities for risk management.

2.4 CONCLUSION

This chapter answered the first research question by describing the objectives and instruments of the gas roundabout (2.1). Within the scope of this research (see figure 4), the gas roundabout policy is aimed to *directly* and *indirectly* contribute to the upstream investment climate, as presented in the figure 10 below. Directly, the gas roundabout contributes to the upstream investment climate by deploying five measures (2.2). Indirectly, the gas roundabout policy contributes to the upstream investment climate by developing a physical and virtual natural gas hub (2.3). This research assumes that this development is solely related to the presence of the gas roundabout policy.

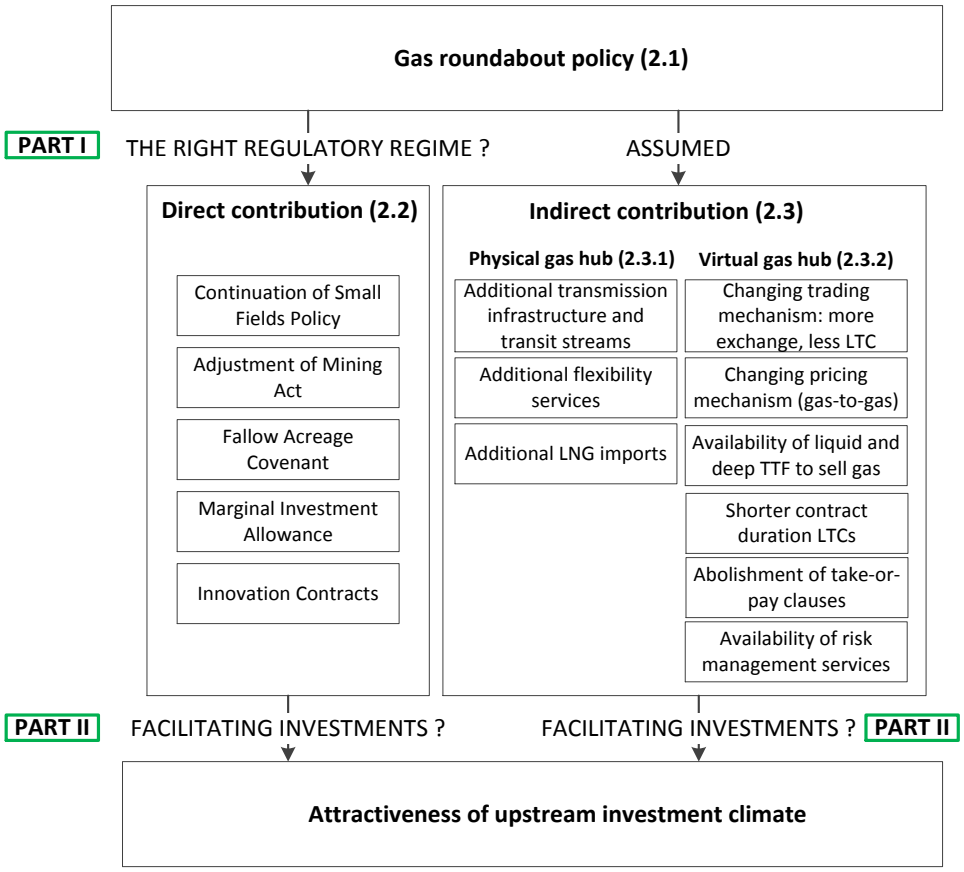


FIGURE 10: CONTRIBUTING FACTORS OF THE GAS ROUNDABOUT POLICY TO THE UPSTREAM INVESTMENT CLIMATE

As indicated in the figure 10 above, to determine the contribution of the gas roundabout policy to the attractiveness of the upstream investment climate, the relations need to be substantiated. The first PART of this study will address the relation between the gas roundabout policy and the elements which are assumed to have a direct effect. These identified measures are seen as the *regulatory regime*, aimed to contribute to the attractiveness of the upstream investments climate.

The second PART of this research will explore the contribution of the identified *direct* and *indirect factors* to the attractiveness of the upstream investments climate. The third phase of research will elaborate on the interaction between these two parts, and answer the main research question of this study.

PART I:

THE RIGHT REGULATORY REGIME?

This part will address the contribution of the gas roundabout policy to the regulatory regime in which upstream investments take place. The regulatory regime of the gas roundabout policy is defined as the set of policy objectives, -instruments and –processes which are aimed to contribute to the attractiveness of the upstream investment climate.

3 POLICY MAKING, -ANALYSIS AND -EVALUATION THEORIES

With the aim to develop a perspective which can be used to analyze and evaluate the gas roundabout policy in the next chapter, this chapter will answer the following theoretical research question:

How can the gas roundabout policy be analyzed and evaluated?

Policy making and policy analysis and -evaluation are closely related. There are very different perspectives on policy making. These different perspectives also require different perspectives of policy analysis and evaluation, aligned with the policy making perspective.

Two perspectives on policy making, -analysis and -evaluation will be briefly described in this chapter. Paragraph 3.1 will elaborate on the rational-analytic, project-approach of policy making and the associated analysis and evaluation perspective. Paragraph 3.2 will elaborate on an alternative perspective, a process-approach to policy making, -analysis and -evaluation. Paragraph 3.3 will conclude by describing how it can be determined which perspective is most suitable for a certain empirical case, and which questions must be empirically answered to analyze and evaluate the policy in such a case.

3.1 RATIONAL-ANALYTIC PROJECT APPROACH TO POLICY MAKING, ANALYSIS AND EVALUATION

The first section of this paragraph will elaborate on the rational-analytic project approach to policy making, or decision-making. The second part will elaborate upon the associated perspective on analysis and –evaluation. The Chamber of Audits (Dutch: Algemene Rekenkamer), the Central Planning Office (Dutch: CPB) and many other leading institutes apply this classical policy analysis and –evaluation perspective. This perspective is embedded in Hoogerwerf's (1998) book "Governmental Policy: An Introduction to the Science of Public Policy."

3.1.1 ELEMENTS OF THE PROJECT APPROACH TO POLICY MAKING

Hoogerwerf states: "Classical policy analysis studies the content of policy, the processes of policy and the effects of policy in their political and societal context. Policy analysis enables analysts to better understand and judge policy. Elementary and complementary aspects of policy analysis are the content, the process and the effects of the policy. The used approach of the policy analysis is *descriptive* or *empirical-analytical*, aiming to systematically gain insight about the policy, by approaching the policy using logically coherent definitions, and using empirically testable relations between these definitions." (Hoogerwerf, 1998:19) The three sections below will describe the terms *problem perception*, the *policy content* and the *policy process* of this perspective.

PROBLEM PERCEPTION

Policy making starts with the observation that there is a problem, and that this problem takes place within a hierarchical context where the policy maker can make autonomous decisions to solve these problems. Hoogerwerf (1998) defines a problem as a discrepancy between a norm and a perception about an actual situation. With that, the problem perception is depending on both the norms and desired situation of the policy maker. Problems can be small or big, simple or complex and tame or wicked, although most problems have a hybrid character. (Hoogerwerf, 1998:40) The first step of the policy maker is to perform a substantive problem analysis, to delineate the problem and to decrease the complexity by separating the problem in sub-problems.

POLICY CONTENT

Drucker (1967) proposes an analytical approach to problems: "An effective decision-maker makes decisions as a systematic process with clearly defined elements and in a distinct sequence of steps." (Drucker, 1967:98) The problem definition results in the policy objective. Simon (1997) describes the analytical approach to decision-making as *narrowing down alternatives*. These problems are definable and separable and may have solutions that are findable (also see Rittel and Webber, 1973:160). The policy instruments are determined by this *narrowing down.* Hoogerwerf suggests that decisions are made consequential, based on preferences. This is based on March and Olson's *logic of consequences* (March and Olson, 1998). Allison (1971) refers to this

paradigm as the *rational actor paradigm* to decision-making (Allison, 1971:32). Hoogerwerf defines policy content as: "Pursuing or aiming particular objectives, by applying means within a certain time-horizon." (Hoogerwerf, 1998:23) Therefore, policy content must be defined in terms of assumptions about the means, objectives and time-horizon of the policy. Means are defined as instruments which can be used by the policy maker, or any other actor, to achieve his objectives (Hoogerwerf, 1998:25). The choice for certain instruments to achieve the policy objectives is based on a set of logical assumptions on how those instruments will contribute to the problem situation. The overall set of causal, final and normative assumptions is referred to as the *policy theory*. (Hoogerwerf, 1998:25)

POLICY PROCESS

The policy process is another elementary aspect of policy making. Hoogerwerf defines the policy process as: "The dynamic course of actions and interactions, contextualizing the policy." (Hoogerwerf, 1998:26) The policy process knows several phases, which are not always present or may occur in different sequences and orders, but which can help to analyze the policy process. The initial phase is the agenda-setting, where the problems are being defined, scoped and determined. After a preparation-phase, the policy is decided upon in the decision-making phase. In these two phases, the objectives, means and time-horizons are determined. After a subsequent implementation phase, a policy is often evaluated." (Hoogerwerf, 1998:27) The decision-making process is characterized by the hierarchical structure, in which there is a unilateral dependency between the policy maker and other actors. De Bruijn and Ten Heuvelhof (2008) characterize such a hierarchical decision-making process by (i) the regular and sequential nature of the activities, (ii) the pre-defined phases, (iii) the stable character of actors, (iv) one *arena* with a clear starting point and end point, (v) a stable content of the problem, (vi) the problem is perceived as stable, and (vii) a consistent and predictable character of the decision-making process. (De Bruijn and Ten Heuvelhof, 2008:26).

3.1.2 PROJECT-BASED POLICY ANALYSIS AND EVALUATION

In order to analyze and evaluate a policy from a project-perspective, Hoogerwerf (1998) has established rules to *reconstruct* the *policy theory*, because such a policy theory is often not explicitly stated in policy publications. Based on this reconstruction, a policy analyst can evaluate the (normative, causal and final) assumptions of the policy as a first step of policy evaluation. Thereafter, empirical information can be gathered to answer goal-rational questions, based on the *ex post* policy outcomes such as (Hoogerwerf, 1998:29):

- Does the policy meet its objectives? (effect)
- To what extent are the objectives met by means of the policy? (effectiveness)
- What is the balance between costs and benefits of the policy? (efficiency)

After the analysis and evaluation, Hoogerwerf (1998) distinguishes between an *active* and an *empty* policy. In an active policy, the policy means are effectively deployed and deliver a positive effect to the problem. Evaluation is with that a *goal-rational activity.* (De Bruijn and Ten Heuvelhof, 2008:85) Explanations can be looked for to explain why a policy might not be *active.*

An *empty policy* can be caused by the type of problem: *tame* or *wicked* problems. Wicked, or untamable, problems are hard to mitigate by policy means (Rittel and Webber, 1973; Hoogerwerf, 1998:41). A second cause for *empty policy* can be that the factual *deployed* policy is not aligned with the actual *intended* policy. In such a case, policy can be *nothing more than a name* or even result in other problems. Examples of passive policies are *symbolic policy* or *conservatism* (Hoogerwerf, 1998:42). A third cause for an empty policy can be a hampering decision-making process which does not result in an active policy (Hoogerwerf, 1998:42). The project-approach to policy making, analysis and evaluation is most suitable to make assumptions about *tame* policies which are not characterized by a dynamic nature or a high level of interrelatedness with other policies or elements.

Box 1 below characterizes wicked problems. The next paragraph (3.2) will position the process-approach contrarily to this project-based approach to policy making, -analysis and evaluation.

BOX 1: WICKED PROBLEMS

Rittel and Webber (1973) distinguish between tame and wicked problems. Tame problems are often addressed by engineers and scientists, and are solved by the analytical perspective. However, many problems of governmental planning are ill-defined, and they rely upon elusive political judgment for resolution. These problems are referred to as wicked problems by Rittel and Webber (1973):

- There is no definite formulation of a wicked problem;
- Wicked problems have no stopping rule, there is not a best solution;
- Solutions to wicked problems are not true-or-false, but good-or-bad;
- There is no immediate and no ultimate test of a solution to a wicked problem. Full consequences cannot be appraised until waves or repercussions have completely run out, and we have no way of tracing all the waves through all the affected lives ahead in time or within a limited time span.";
- Every solution to a wicked problem is a "one-shot operation"; because there is not opportunity to learn by trial-and-error, every attempt counts significantly;
- Wicked problems do not have an enumerable set of potential solutions, nor is there a well-described set of permissible operations that may be incorporated into the plan;
- Every wicked problem is essentially unique. There are no classes of wicked problems in the sense that principles of solutions can be developed to fit all members of a class;
- Every wicked problem can be considered to be a symptom of another problem;
- The existence of a discrepancy representing a wicked problem can be explained in numerous ways. The choice of explanation determined the nature of the problem's resolution. The choice of explanation is arbitrary and depends upon the 'world-view' of the analyst or policy maker.
- The planner has no right to be wrong. The aim of dealing with wicked problems is not to find the truth, but to improve some characteristics of the world. It's about *satisfying* instead of *maximizing (also see Simon, 1956)*

3.2 PROCESS APPROACH TO POLICY MAKING, ANALYSIS AND EVALUATION

Because of the existence of these wicked problems, Allison (1971) places the *political perspective* contrarily to the *rational-analytical perspective* to decision-making, as it is discussed in the previous section. The political perspective does not agree with Drucker's assumptions of one single decision maker, complete information and a univocal preference structure. Lindblom and Woodhouse (1993) extend Simon's (1994) proposition that cognitive abilities limits *rational* decision-making. They state that there are also other limits to rational policy analysis because it is too slow and too costly, it is fallible, it cannot tell us conclusively which problems to attack and it cannot resolve conflicts of value of interests (Lindblom and Woodhouse, 1993:22). Lindblom and Woodhouse: "Analytical policy making is inevitably limited and must make room for politics." (Lindblom and Woodhouse, 1993:22) Another limitation to rational decision-making in the presence of networks (De Bruijn and Ten Heuvelhof, 2008). A network is characterized by a variety of different actors with different power, instruments, interests and objectives, and these actors have mutual dependent relations with each other. (See appendix 1 for the gas roundabout-network) Compared to the project-based approach to policy making, the process-based approach is far more suitable to address wicked problems, and decision-making in networks.

3.2.1 ELEMENTS OF THE PROCESS APPROACH POLICY MAKING

In opposite to the project-based perspective, the three sections below provide the process-based perspective to the problem perception, the policy content, and the policy process.

PROBLEM PERCEPTIONS

The process-based decision-making perspective is relevant when policy making takes place within a network of multiple interrelated actors, who all have their own problems, norms and priorities (De Bruijn and Ten Heuvelhof, 2008:61). There are not *problems*, but problem *perceptions,* and the main concern of actors is to

gain sufficient support from other actors who are required to *satisfy*[1] their *problem perception*. An analysis of the problem is of limited value, as the main concern is to influence the problem perception of other actors.

This can for example be done by 'priming' or 'framing' which are strategies to create a context in which parties are sensitive for a certain problem perception by for example creating a sense of urgency or couple issues (De Bruijn and Ten Heuvelhof, 2008:62). Framing and associated strategies can be used to formulate a problem perception or –objective (*policy-framing*), and during the process to gather support or steer the process (*issue-framing*). Box 2 below elaborates more on framing.

BOX 2: FRAMING – DIFFERENT INTERPRETATIONS

Although numerous management, political and scientific books (e.g. De Bruijn, 2012; Lakoff, 2004; Korsten, 2008; Scheufele, 2000) are devoted to *framing,* there is no single area of application or definition for framing. Most of the scientific articles about framing are related to communication, media, mass-opinion development, psychology, sociology, or rhetoric. De Bruijn and Ten Heuvelhof (2008) and Korsten (2008) provide us with theoretical insight about framing related to *policy making*. This is related to *process-approach* (De Bruijn and Ten Heuvelhof, 2008) and *wicked problems* (Korsten, 2008) and therefore relevant for this research.

Framing and policy know several interpretations and dimensions. A first interpretation of *policy-framing* is provided by Korsten (2008) who describes a *policy-frame* as: "The vision, paradigm or perspective behind a problem or behind a policy. *Wicked problems* result in multiple frames, for different actors. The challenge of policy making is to *re-frame* all these individual frames into a common frame". Framing is defined as: "A way of selecting, organizing, interpreting and making sense of a complex reality so as to provide guideposts for knowing, analyzing, persuading and acting. A frame is a perspective from which an amorphous, ill-defined problematic situation can be made sense of and acted upon." (Korsten, 2008:3, based on Rein and Schön, 1986) This perspective on framing emphasizes on the added value of framing as *conceptualizing*. Korsten (2008): "Frames change gradually, and are referred to as *paradigm shifts".*

A second interpretation of framing is provided by De Bruijn and Ten Heuvelhof (2008), who concern *issue-framing* within the context of decision-making in networks and the *process-approach*. *Framing* is used by actors in a process-environment to, for example, gather *support* for their problem perceptions or solutions, create a sense of urgency, manage the process, involve and exclude parties, or influence the behavior and *problem perception* of other actors. Here *framing* is not a vision or paradigm, but an *instrument* which supports actors in meeting their *process-objectives* such as those listed above. It is a well-thought form of defining and communicating a *problem perception* or an *objective*, aimed at meeting *process-objectives,* in opposition to the *project-approach* where the definition of *the problem* or goal are simply derived from an observation of *the problem.*

A third dimension of interpretation is *message-framing*, mostly used in political debates as a strategy to give messages a certain association for the voter (see De Bruijn, 2012).

In the line of *framing* as used in the second interpretation, there are also other – associated – strategies aimed at meeting certain *process-objectives* (De Bruijn and Ten Heuvelhof, 2008: 62-66). These are for example (i) '*tagging'* or *'naming'* existing initiatives as part of the new policy, giving them only a *new jacket* but possibly increase the attractiveness or broaden the scope of the problem, or (ii) '*priming,'* by for example *inventing a crisis* which results in a sense of urgency. Analyzing *framing* and associated strategies is a *tailored exercise.* De Bruijn (2012a): "Framing can have positive and negative effects," and there are "good and less frames." (also see Korsten, 2008:6).

[1] This research often uses the term 'satisfying.' This term is derived from Simon's (1956) 'satisfycing,' related to his proposition that human beings lack the cognitive resources to optimize. "We usually do not know the relevant probabilities of outcomes, we can rarely evaluate all outcomes with sufficient precision, and our memories are weak and unreliable. A more realistic approach to rationality takes into account these limitations: bounded rationality (Simon, 1956). Satisfycing combines *satisfy* and *suffice.* Many scholars have adapted this perspective, such as Rittel and Webber (1973) on policy theory, and Williamson (1998) in economics. Those scholars do not talk about satisfyicing, but about satisfying, although the meaning is the same. This research will use the term 'satisfying' the same as the latter scholars. Satisfying rather than maximizing, caused by bounded rationality.

CONTENT

De Bruijn and Ten Heuvelhof (2008) describe the *process-perspective* on how policy *content* is determined in a network situation, aimed to satisfy wicked problems. The objective of the policy gives an indication of what the parties want to reach, but this goal can change because parties learn about the process (positionally) and the content (substantively). Where the objective is leading in the project approach, the process approach states that "actors go in search of goals that have sufficient support and that are substantively attractive." (De Bruijn and Ten Heuvelhof, 2008:65) Strategies such as framing and the process set-up may result in goal stretching, or allow the boundaries and scope of the problem perception to evolve. This is how an actor can use the objective to, for example, gain support for his problem perceptions, allows room for manouvre, and couple issues to the objective. The decisions are the outcome of the *decision-making process* of the network, rather than from an "ivory tower" in which a policy theory is developed from which the policy instruments are deduced by *narrowing down* alternatives. Moreover, the content is dynamic and adapts due to the learning of parties in a process.

PROCESS

De Bruijn and Ten Heuvelhof: "Decision-making in a network is the result of a process in which parties have negotiated about a large number of issues. The formal decisions on the *package* will not come as a surprise to them: they have put forward their issues, gone through the process of consultation and negotiation and designed a package." (De Bruijn and Ten Heuvelhof, 2008:75) Decision-making is a matter of *ticking off* what was already been decided. Decision-making is an ongoing process which takes place in irregular, non-sequential streams, rounds or phases (see appendix 4). Actors join and withdraw, and behave strategically, and the policy making process has no isolated starting point or end. The content of the problem shifts, and the problem is perceived as unstructured. (De Bruijn and Ten Heuvelhof, 2008:26)

Decisions are not often formulated in very precise terms, as this would offer little *room for manoeuvre* for the actors. Decision-making has an *open character,* meaning that some options are left open to give parties future opportunities. This not only creates incentives for commitment and cooperative behavior, but also subscribes to the *nature of the problem* and the *bounded rationality* of the involved actors to substantially make complete, consistent and unambiguous decisions.

3.2.2 PROCESS-BASED POLICY-ANALYSIS AND -EVALUATION

As there is no *policy theory* which can be 'reconstructed' such as in the project-perspective, the contribution of policy to a particular problem perception can be analyzed by *tracing the objectives and instruments* of the policy and describe the dynamics of the policy along the following questions:

- What was the policy making perspective of the policy (project versus process)? How can this be explained? Which actors were involved in the process?
- What are the objectives of the policy, and how did they evolve over time? Can we relate the objectives to the problem perceptions of the involved actors? What were the drivers changing the policy objectives? What is the *distinctness* of the objective?
- What are the instruments of the policy, and how did they evolve over time? Can we relate the instruments of the policy (or taken decisions) to the problem perceptions ('*problem-seeking'*) of the involved actors? What were the drivers of these changes in policy instruments? What is the *distinctness* of the instruments?

Distinctness can be determined by *analytically* separating the *policy* from objectives or instruments already in place, but presented or *tagged* as policy*,* or 'new' objectives of instruments which are *framed* or *tagged* as policy, but which would also occur (to some extent) without the existence of the policy.

According to De Bruijn and Ten Heuvelhof (2008), goal-rational *evaluation* in a process approach is impossible because different parties can have different aims and different views as to what goals have been realized. But also, *ex ante* formulated goals are not a guideline for an evaluation because parties can change their goals during the process. Parties may have learnt during a process: about their goals, the right problem definition or the most suitable solution. Or, the context of the policy changed which created the need to *adapt* the policy.

De Bruijn and Ten Heuvelhof have formulated a set of criteria on which decision-making which takes place within networks *can* be evaluated *ex post* or *ex durante* (De Bruijn and Ten Heuvelhof, 2008:86):

- Are the parties satisfied? Do they tolerate the decision?
- Have any problems been solved?
- Have the parties learnt anything?
- Have long lasting relations developed?
- Was the process fair?

In a fair process, all relevant parties were involved; all parties in the process have sufficient chances to realize their interests; the core-values of the parties were respected and the views of the different parties were listened to.

Evaluation is a continuous process, which has more the character of *monitoring* than of evaluation. In addition to that, there are also other reasons why goal-rational analysis and evaluation might be impossible in some situations, originating from other reasons than from the network character of the decision-making process. Firstly, when it concerns a policy which is aimed at the long-term, the policy does not have a (complete) outcome (yet), so *ex post* evaluation is difficult. Secondly, the responsible policy maker is depending on other actors to realize the objectives. Thirdly, there is indistinctness about the relation between deployed policy instruments and effects. In such a case, answering the above listed questions contributes to the insight in the policy.

3.3 How to determine the most relevant perspective for policy analysis and evaluation?

What determines the relevance of both policy analysis and evaluation perspectives? Most certainly, this depends upon the applied decision-making perspective. In turn, the applied decision-making perspective depends upon the context and nature of the problem. Table 3 below lists the most important differences between the two perspectives. Eventually, the analysis and evaluation perspective which best suits the applied decision-making perspective and nature of the problem, is the most relevant to apply on a particular case.

TABEL 3 PROJECT VERSUS PROCESS APPROACH

	Project approach	Process approach
Context of the problem	Hierarchy (one autonomous actor with decision-making power and unilateral relations with other actors)	Network (variety of multiple actors with decision-making power)
	Policy maker can meet policy objectives autonomous (one problem owner and responsible)	Policy maker needs other parties to meet policy objectives (many problem owners and responsible actors)
Nature of the problem	One problem; discrepancy between norm and actual situation (problem seeks solution)	Problem perceptions of multiple actors (solutions seek problems)
	Substantive analysis of problem situation as main issue	Looking for support for problem perceptions as main issue
	Problems are definable and may have solutions that are definable (more take than wicked)	Ill-defined problem perceptions with ill-defined numerous solutions (more wicked than tame)
Content of the policy	Clear, stable policy objective and content, deduced from problem description.	Objective and content are in-stable and depend on what the parties want to reach, deduced from their problem perceptions.
		Dynamic content, not only depending on learning of actors but also due to external developments
	Content is based on normative, final and causal assumptions (policy theory)	Content is the result of the negotiation process

	Narrowing down alternatives for instrument generation	Instruments are result of negotiation process
	Clear defined starting point and end point	No clear defined starting point and end point
	Clear boundaries, limited room from manoeuvre	Evolving boundaries of policy, goal-stretching, naming and framing; room for manoeuvre
Character of the decision-making process	Pre-defined phases	Ill-define phases, rounds or arena's
	Regular, predictable and sequential	Capricious
	Stable character and involvement of actors	Dynamic actor involvement, parties come and go
Criteria for analysis	Reconstruction of policy theory	Tracing the course of policy
		Determine contribution by focusing on distinctness of policy
	Static	Dynamic (recognize interaction with other policies and developments)
Criteria for evaluation	Goal-rational evaluation	Tracing the course of policy
	Ex post	Ex post and Ex durante, evaluation is a continuous process (monitoring)
		Suitable for monitoring long-term policies
A right/ satisfying regulatory regime?	• Policy theory is appropriate; • Policy meets its objectives; • The policy is effective; • The policy is efficient;	• Policy making perspective suits the nature and context of the problem; • The parties are satisfied; • Problems have been solved; • Parties have learned; • Relations have been developed; • The process was fair.

3.4 CONCLUSION

The second research question of this study can be answered. The gas roundabout policy can be analyzed and evaluated by firstly identifying the context and nature of the problem, the content of the policy and character of the decision-making process (see table 3). This will determine the most relevant *perspective* for policy analysis. Thereafter, the policy can be analyzed and evaluated by one of the two described perspectives: the project-based, or the process-based approach to analysis and evaluation. The two perspectives each apply other criteria to determine whether the regulatory regime is *right* (project-approach) or *satisfying* (process-approach) as illustrated in this chapter (also see table 3).

To answer the research question of chapter 4, the gas roundabout policy must be analyzed and evaluated. This can create insight in the extent to which the policy contributes to the *regulatory regime* by which investments have to be facilitated in order to realize the objectives of the gas roundabout policy.

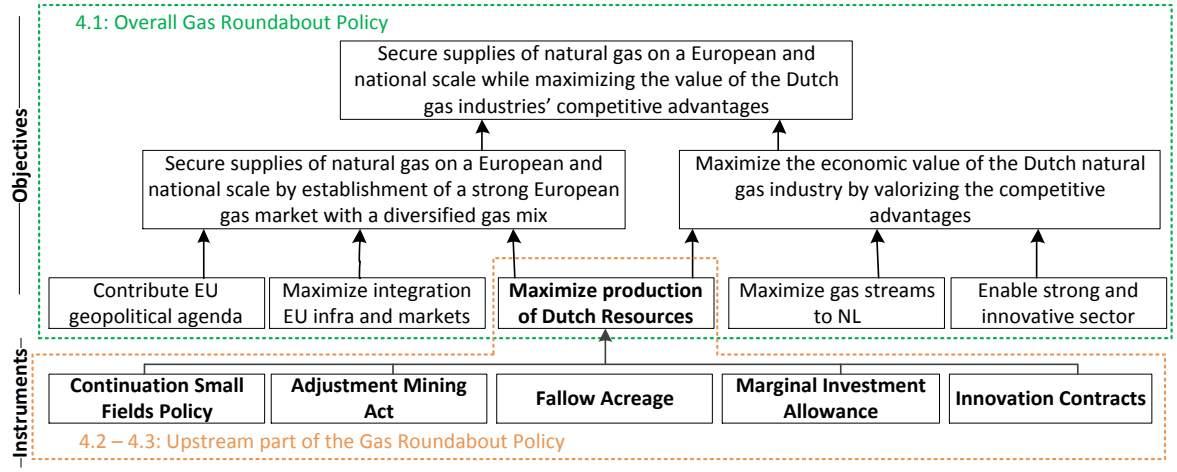
4. ASSESSING THE GAS ROUNDABOUT POLICY

This chapter will apply the theoretic insights from the previous chapter to answer the following research question:

What is the contribution of the gas roundabout policy to the regulatory regime in which upstream investments take place?

This chapter will make use of empirical information from policy publications related to the gas roundabout policy (see appendix 5 for a comprehensive summary) and three interviews with policy makers from the Dutch Ministry of Economic Affairs, Agriculture and Innovation (EL&I) who were closely involved in the development of the gas roundabout policy.

The figure 11 below illustrates the objective of the gas roundabout policy, based on chapter 2. Also the direct contributing factors to the upstream investment climate are included. This chapter will first examine the most relevant perspective for analysis and evaluation, by looking at the overall gas roundabout policy (4.1). This will result in the most relevant perspective for analysis and evaluation, which will be conducted in the subsequent paragraphs (4.2 and 4.3). The scope of the analysis and evaluation will be related only to the upstream part of the gas roundabout policy, as this is the main concern of this research. Paragraph 4.4 will conclude by answering the research question, and will raise considerations for PART III of this study. This chapter will end with a reflection on the applied theories (4.5).



FIGUUR 11: GAS ROUNDABOUT POLICY - SCOPE OF CHAPTER 4 (SOURCE: EZ, 2009; EL&I, 2011)

4.1 RELEVANT PERSPECTIVE TO ASSESS THE GAS ROUNDABOUT POLICY

As explained in the previous chapter, deciding upon a relevant perspective for analysis and evaluation depends on the context and nature of the problem, the content of the policy, and the character of the decision-making process (see table 3). This paragraph will identify whether the gas roundabout policy can best be analyzed from a project perspective, or from a process perspective.

CONTEXT OF THE PROBLEM

As explained in table 3, the context of the problem describes the role and position of the *problem owner(s)* and involvement of other actor's (hierarchy, network or hybrid structures). The *progress report of the gas roundabout policy* states the following (EL&I, 2011): "The objective of the gas roundabout is to ensure that the Netherlands can maximize its competitive advantage in the gas sector. Individual companies, executing individual projects, implement the gas roundabout strategy to their own vision and commercial support, contributing to the objective of the gas roundabout policy. The government has a stimulating role for these companies, but there is no single actor in charge, nor is there a hierarchical relationship for decision-making or

guidance." (EZ, 2011:3) This indicates that the main *problem owner* – being the Dutch ministry of EL&I – is depending on many other actors to realize their policy objective, as these other actors will actually invest and engage in projects contributing the gas roundabout´s policy objective. There are *mutual dependent* relations between EL&I and the other actors. The network of actors depend upon EL&I for its *stimulating role* (actively setting the right regulatory regime and facilitating investments) and EL&I depends on other actors for their *investments* and *engagements* in projects. Therefore, the context of the problem can be seen as a *network* of actors with different interests, roles and power. How can we characterize this network?

The actors that together form the network are different; this has to be taken into account by the *intervening actor* in that network – the ministry of EL&I. The variety within the network *Dutch natural gas value chain* is enormous (see appendix 1 for actor-network analysis). For example, there are many different upstream gas producers (e.g. NAM, Centrica, ONE), without a particular interest in security of supply or valorizing Dutch competitive advantages. These firms are merely interested in maximizing shareholder value. There are also small, green-gas producers, with their own limited agenda of sustainability and downstream requirements (e.g. Enexis). In addition to that, there are both incumbent gas traders (e.g. GasTerra), possible new entrant gas traders (e.g. Dong), project-developers in LNG-terminals or gas-storage facilities whose priorities are related to their own projects (e.g. Vopak), the regulator of the transmission network (NMa), the transmission-system operator who is concerned with balancing new and different supplies (GTS), and an investor in transmission infrastructure with the ambition to expand to other countries (Gasunie). All of these actors are only interested in a particular part of the Dutch natural gas value chain, a particular aspect of *Dutch competitive advantage,* and with that only interested in a particular part of the gas roundabout policy. Different companies, who are interested in the same domain, may also have different reactions to the intervention. For example, when distribution system operator (DSO) 'A' has the strategy to accommodate green-gas, and DSO 'B' has not, both will react different to the intervention. It can therefore be said that the network can be characterized by a high *variety*. This gives limited possibilities for *tailor-made* approaches for EL&I, but also urges the need for some coordination and steered-cooperation from out EL&I, as the individual actors would otherwise not engage in a *common* project.

Moreover, the network can be characterized by its *closedness.* Many of the actors already have their own strategies for investments, which can only be influenced by the policy to a limited extent. Commitment of the most important *closed parties* is essential for the policy maker. The last character of the network are the different levels of *interdependency.* With state-participants such as EBN and Gasunie on the one hand, and small private oil firms such as Tullow on the other hand, the level of interdependency between EL&I and the actors differ. Moreover, some parties have a high *constructive* power (e.g. EBN, Gasunie), where others have limited (e.g. Tullow) depending on their strategy, resources and capabilities. The state-participants have *regulated constructive* power, and are therefore more affected by possible government intervention.

Concluding, the context of the problem can be seen within the network as characterized above, with a special role for the Dutch government, resulting in autonomous *decision-making power* with regard to the policy instruments, but a strong dependency upon other actors for their investments. The broad character and scope of the policy can be explained by these network characteristics (*variety* and *closedness*). The special *interdependency* between EL&I and the state-participants explain their prominent role to realize the policy objectives, because the Dutch government has *decision-making power* for the investments of these parties. Nevertheless, the result of the policy is strongly dependent on investments from actors which can only be limitedly influenced by governmental policy, who face *information asymmetry.*

NATURE OF THE PROBLEM

Given the above *contextualized* problem, the *nature* of the problem can now be described (see table 3). Because of the extensive variety of actors, there is no single problem perception within the network. Apart from the ministry of EL&I, none of the involved actor's *core-values* relate to the policy objectives: contributing the security of supply and contributing to the valorization of Dutch competitive advantages. Actors are interested in their individual sub-objectives, ranging from realizing international growth as wholesale trader

(GasTerra), international expansion of infrastructure (Gasunie), maximize Dutch E&P activities (EBN), develop green-gas networks (Enexis) or maximize share-holder value (Tullow). The network therefore consists of *multiple problem perceptions* rather than one single problem perception. Actors do not only have different areas of interest, driving their problem perception, but can also disagree upon each other's problem perceptions. For example, the *problem perception* of transmission-tariffs may differ among the NMa and Gasunie. There is no common agreement about the *desired situation,* as the desired situation of Gasunie would be maximum levels of import, and EBN's desired situation a maximum indigenous production to meet demand. This explains why the gas roundabout policy is very broad, and why the Dutch government does not make explicit choices about the *desired* energy mix (EZ, 2008). This would only result in resistance and lower commitment of relevant parties.

The gas roundabout policy is aimed to satisfy a *wicked problem* (see box 1). Unlike tame problems, it is impossible to exhaustively formulate the problem, containing all the information that the policy makers need to understand and solve the problem. This is caused by the *information asymmetry,* and nature of the actor-network. It is impossible to develop an exhaustive inventory of all conceivable solutions ahead of time to deal with this problem. Technological breakthroughs, geopolitical issues, a sudden collapse of the international gas market, and other numerous factors make it impossible for the policy makers to know on forehand what all solutions are to solve the problems. Moreover, there is no best solution for the problems of 'security of supply' and 'maximize competitive advantages.' Solving the two problems of the gas roundabout is therefore more about satisfying than about completely solving the problem. Not only because the problem is wicked, but also because the problem perceptions of involved actors are different results in a complex nature of the problem. Involved actors have derived *problem-streams* or associated *solution-streams* from their problem perceptions (see Kingdon, 1995 and appendix 4). In the network of actors, all with their own problems or solution, the individual actors look for a *window of opportunity* to gain support or attention for their problem perception.

Concluding, the nature of the problem asks for a process approach to decision-making, and realizing some agreement about the *desired* situation of a gas roundabout among actors. The context and nature of the problem also asks for a dynamic policy which is open for learning, and anticipates on a changing actors-field and changing conditions. Given the broad and evolving scope of the gas roundabout policy (see appendix 5), the policy seems to reflect this nature of the problem.

CONTENT OF THE POLICY

A third step to determine the most relevant approach to policy analysis and evaluation is to emphasize on the content of the policy (see table 3). The *progress report gas roundabout* (EL&I, 2011) stated that the gas roundabout has no owner, nor a predefined goal or finish (EL&I, 2011:1). Although the two general objectives of the gas roundabout policy remained constant over time, there were numerous amendments to the scope of the objective, content and instruments of the policy. The gas roundabout policy is characterized by its *incrementalism* and dynamic scope (see appendix 5).

The importance of *security of supply* was initially a low objective on the gas roundabout policy-agenda (AER, 2005), which was initially aimed to contribute to the European Liberalization process. In later publications, from 2006 onwards, *security of supply*, has become top-priority. The scope of the gas roundabout policy also incorporated several other elements over the years. Examples are the role of shale gas in upstream E&P, the importance of joint-innovation, green-deals, the more explicit role of GasTerra as midstream buyer, and the privatization of Gasunie (EL&I, 2011).

It can be concluded that the content of the gas roundabout policy is not stable and well-defined, but incrementally evolving and adapting to the actor- and problem environment or context. The content of the gas roundabout policy is depending on several external developments. Firstly, the policy is depending on market-developments, such as the Russia-Ukraine crisis in 2006. Secondly, the policy is depending on industry-developments, such as the prospects of shale gas in the south of the Netherlands and the results of the Mining

Act evaluation. Also political-developments, such as *innovation contracts, top-sectors* or *green-deals* were attached to the content of the gas roundabout policy.

The content of the policy is not only depending on external developments, it also depends on the political context and past policies. Historically, the Dutch government aimed to facilitate upstream investments by looking at the entire natural gas system as "Gasgebouw" (Roggenkamp, 2007). The belief of the government to stimulate upstream investments by looking at the midstream part of the natural gas system has been proven to be effective, as the small-fields policy and the "Gasgebouw" structure largely facilitated upstream production and investments. These beliefs can be seen as the *informal institution*, driving the decisions for a certain regulatory regime and government involvement (see also CIEP, 2006:22). The initial *informal institutions* come down to two principles, stated in *Nota de Pous* (1962): the market-value principle, and the belief that production should be in harmony with the sales of natural gas (see Correljé and Odell, 2000). External developments in the international natural gas systems resulted in sudden or gradual changes of these informal institutions. For example, the oil crisis in the 70s suddenly changed the beliefs about security of supply, and government involvement to promote small-fields. The more gradual European liberalization process, the gradually declining Dutch production levels, and the emergence of global LNG markets also affected these *informal institutions*.

The publication of the AER (2005) can therefore be seen as a reflection on these gradually changing *informal institutions* – being the vision or paradigm behind the policy, the beliefs about government involvement and *norms and values*. According to Korsten (2008), the metaphor ´gas roundabout´ is the *frame* of these new informal institutions. As with Korsten´s definition of a *frame,* informal institutions change gradually (see Williamson, 1998) as the shifting beliefs, norms and values have to be institutionalized – both by the government, and the market parties. Moreover, this is a natural and implicit process, taking many years and has an incremental, unpredictable and rigid nature. Koppenjan and Groenewegen (2005) describe that it is hard to change or design institutions – such as beliefs over government involvement in upstream natural gas industries, or developments of natural gas markets – because institutions are robust, or may be path-dependent. This perspective does not only explain why the gas roundabout has a changing, and very broad scope, but also why a project approach is incapable to analyze or even evaluate the gas roundabout policy. Informal institutions can simply not be judged of being right or wrong as these concern the societies´ *most wicked* problems.

The instruments of the gas roundabout policy are not the product of *narrowing down* alternatives, as was indicated by an EL&I-official: "The policy did not start with a careful trade-off between alternatives, it is a process which continuously adapts to the market and industry," also, "The gas roundabout policy is a *brown-field* process. We cannot develop a new natural gas sector from the start, and the policy has to cope with structures from the past and initiatives of other policies – such as the top-sector policy, or innovation contracts – or private projects." The content is not the result of negotiations between EL&I and other actors, but more the result of continuous developments of the industry and markets, a *multi-issue agenda*. Also, the policy is influenced by the decision-making process and the actor-network, as will be described in the next section.

CHARACTER OF THE DECISION-MAKING PROCESS

Decisions were taken by EL&I, but in close dialogue with the industry. The *gas hub consultative platform* was established to discuss initiatives and strategies of the gas roundabout policy (EL&I, 2010). EL&I-official: "The gas roundabout policy is the example of the *new industry-politics,* which is based on the character that the government facilitates economic activities by setting the regulatory regime, but also adjust these policies when required from out the industry." On top of the policy agenda of the gas roundabout policy is "Together with the industry, the *gas hub consultative platform* has to result in tangible measures to stimulate the Gas roundabout policy." (EL&I, 2011:14) Also the *Dutch Energy Report* (2011) indicated that there is no unilateral decision-making process, and that the Gas roundabout is positioned as *modern industry policy* and *energy is economics.* (EL&I, 2011a:3) Some recommendations of the Gas hub consultative platform were therefore embedded in the gas roundabout policy (EL&I, 2011; EL&I, 2011a). EL&I-official: "Eventually, it is the government who decides

upon the initiatives and regulations, but the consultative platform serves as an important driver for policy making, and creates *common understanding* and *support* from the industry." The consultative platform and the subsequent working groups, were arranged ad-hoc, and had an open character according to the responsible EL&I-official. "We want to involve as many parties as possible, and do not strategically exclude certain parties." There were no pre-defined rounds for the consultative platform, and it is uncertain whether a future platform will be organized. Concluding, the character of the decision-making process also asks for a process approach, rather than a project approach for analysis. However, the decision-making process cannot be characterized as a complete process according to De Bruijn and Ten Heuvelhof (2008), as the gas roundabout's decision-making process also involves unilateral hierarchical decision-making by EL&I on the policy objectives and instruments.

CONCLUSION

The above sections indicated that the gas roundabout can be seen as a *network problem*, and corresponds with most of the theoretical characteristics of a network as described by De Bruijn and Ten Heuvelhof (2008): a variety of actors with mutual dependent relations and different problem perceptions. Also, the nature of the problem and content of the policy indicates that the policy allows dynamics, and is clearly aimed to satisfy a wicked problem. Therefore, the relevant approach to analyze and evaluate the policy would be the *process approach.*

As mentioned in the introduction, the gas roundabout policy is already assessed by the Dutch Chamber of Audits (CoA) (Algemene Rekenkamer, 2012) and consultants of Brattle (2010). EL&I-official: "Assessing the gas roundabout policy as a project is limited, as was also recognized by the Minister of EL&I in his reaction to the report of the CoA. The dynamics and long-term nature of the policy does not allow for such an approach, as this would give a wrong and over-simplified representation of the reality." See box 3 below for a reflection on both studies, explaining the shortcomings of both studies, and reflecting on the criticism on both studies from the project-process perspective.

BOX 3: Reflecting on Brattle (2010) and the Chamber of Audits (2012)

Brattle (2010) *The economic impact of the gas roundabout policy*

Brattle calculated the economic impact of the gas roundabout for the Dutch economy. They established two scenarios, in which one scenario was business-as-usual, and the other was comprised of assumptions about the effects of the gas roundabout policy on investments by market parties. For upstream investments, they assumed that an annual additional 15 explorations wells would be drilled in the gas roundabout scenario. They also assumed that the policy would result in expansion of the GATE-terminal, an additional LNG-terminal at the Eemshaven, an additional storage-facility, and an additional annual growth rate of the TTF of 20%. These investments sum up to €9 billion, having an economic output of €22 billion over the period 2010-2030. The majority of these additional investments and output (55%) was derived from the 15 additional exploration wells upstream.

Dutch Chamer of Audits (CoA) (2012) *Usefulness, necessity and risks of the gas roundabout policy*

The CoA heavily criticized the gas roundabout policy. The scope of the study was related to one aspect of the policy: investments by Gasunie in the German grid, and by EBN in gas-storage Bergermeer. It was concluded that no supporting studies or policy theory was ex ante developed to build the gas roundabout policy on. Also, no alternatives were compared with this policy, which is culpable because the policy objectives could possibly also be realized by other means (e.g. renewable energy, or higher imports). No ex ante cost-benefits analysis was performed, and future developments of the gas market were not mitigated ex ante. The report heavily criticized the lost investments of publically-owned Gasunie in the German grid. Also the provision of information to the Dutch parliament is lacking, and the public values were not properly incorporated in the investment decisions by the state-participants Gasunie and EBN.

Often heard criticism on Brattle

The assumption that the policy would result in 15 annually additional exploration wells is not substantiated. Which policy instruments would in which case result in these investments? Also, the assumptions are

incomplete, as there are also other possible benefits of the policy, apart from additional exploration wells. And, to realize an additional 230 bcm over 20 years, it takes more than 15 exploration wells: tail-end production, unlocking of contingent resources, and more. The potential of unconventional gas is also not addressed by Brattle. Lastly, Brattle assumed that the small-fields policy would result in the most added value. But this policy is independent from the gas roundabout policy.

Criticism on Dutch Chamber of Audits, by Minister M.J.M. Verhagen of EL&I

Minister of EL&I: "The report already assessed a limited aspect of the gas roundabout policy, which is aimed at a long-term objective," and: "No attention is given to other, already existing drivers for the investments of Gasunie: liberalization. Policy only had a limited effect on these investments. Also, the gas roundabout policy was developed with all relevant parties, and with that substantiated (Algemene Rekenkamer, 2012:p.23)."

Criticism explained from a project versus process approach

The main criticisms on the project-approach evaluations of Brattle and CoA of the gas roundabout policy can be summarized as: it is impossible to make ex ante trade-offs and assumptions (a policy theory), the policy is depending on third parties for investments, the policy cannot be seen separate from other (market) developments and it is fallible to ex post evaluate an on-going long-term policy without a pre-defined goal of end-point. These criticisms are common on project-based evaluations of problems and policy which can better be analyzed from a process perspective. This study will therefore contribute to the understanding of the policy, from the most relevant perspective: the *process perspective.*

4.2 A DYNAMIC ANALYSIS OF THE UPSTREAM PART OF THE GAS ROUNDABOUT POLICY FROM A PROCESS-PERSPECTIVE

Where the previous paragraph identified the most relevant perspective, this section will analyze the upstream part of the gas roundabout policy from a process-perspective. In line with table 3, the decision-making process (4.2.1), the policy objectives (4.2.2), and the instruments of the policy (4.2.3) related to the upstream investment climate will be analyzed. To answer the research question, it is necessary to analytically separate the policy from other developments by "tracing" (see 3.2.2). By doing so, it can be analytically determined what the actual contribution of the policy is to the regulatory regime in which upstream investments take place. With that, this study will go beyond the descriptive preliminary analysis of the policy from chapter 2.

4.2.1 ANALYZING AND EXPLAINING THE DECISION-MAKING PROCESS OF THE GAS ROUNDABOUT POLICY

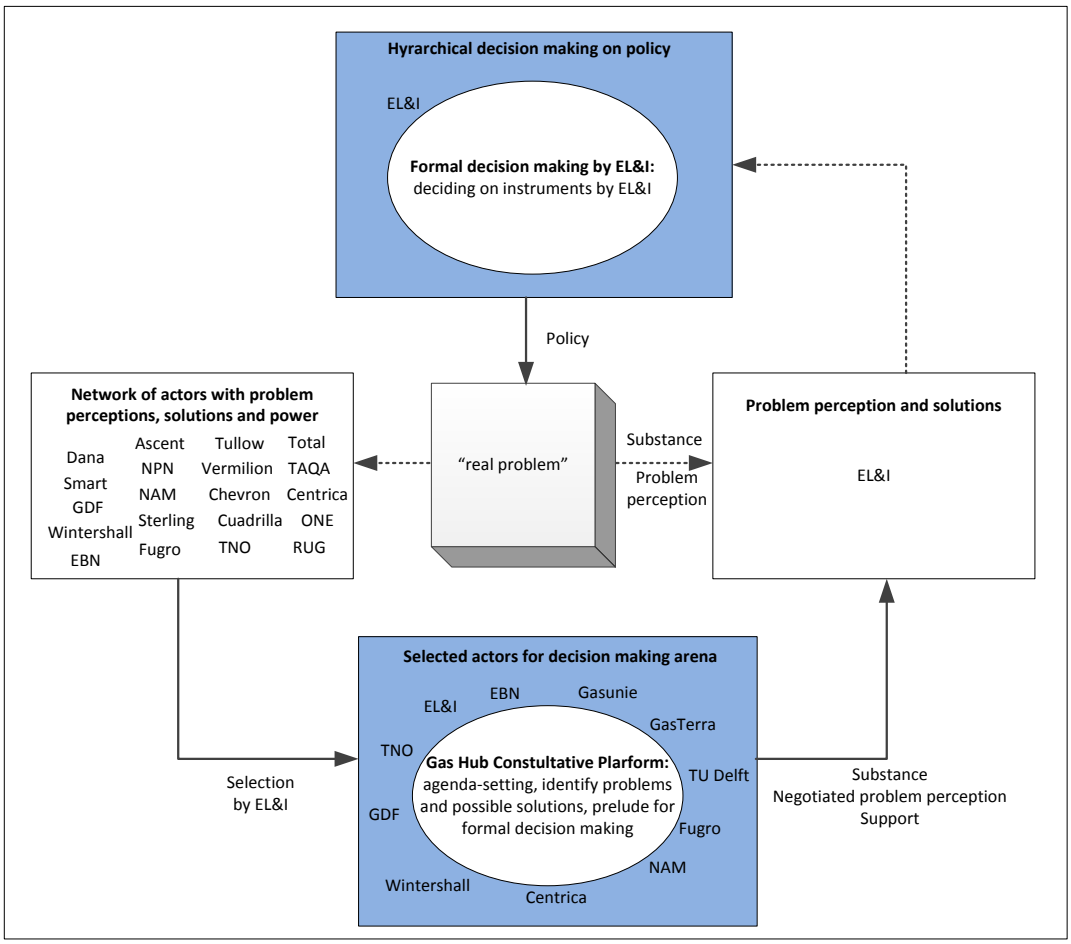
This section will analyze the decision-making process concerned with developing the gas roundabout policy. As mentioned in the previous paragraph (4.1), decision-making on the gas roundabout policy is characterized as hierarchical decision-making by EL&I, in close dialogue with the actor-network by means of the *gas hub consultative platform*.

It is important to mention that the decision-making process of the gas roundabout policy – e.g. determining the agenda, objectives, instruments, involvement and roles of actors, and strategies of the policy – is different than the decision-making process for investments by market parties. The decision-making on investments by market parties is addressed in PART II of this study, and PART III will elaborate on the dynamics between those two types of decision-making. The decision-making perspective analyzed in this section is the *gas hub consultative platform* and *the formal hierarchical policy making*, as marked blue in the figure 12 below.

GAS HUB CONSULTATIVE PLATFORM

The gas hub consultative platform (*platform* from this point forward) explicitly addressed the upstream investment climate in one of the four working groups. The involved actors were EBN, exploration company Fugro, GasTerra as largest buyer of the natural gas, Gasunie, oil firms GDF, NAM and Wintershall, and knowledge institutes TU Delft, RUG and TNO. In subsequent working groups, addressing *financial enablers* and *technical enablers*, also Centrica joint as oil firm. The decision to invite this particular group of actors was discussed with the responsible EL&I-official of the platform. "EL&I aimed to explore the problems and possible

solutions together with the industry, this was the main argument to organize the platform. The participants of the platform were based on the core of state-participants (EBN, Gasunie, GasTerra), knowledge institutes, and the most important oil companies (NAM, Wintershall, GDF). It was intended to organize the platform as open as possible. The results of the platform were two follow-up meetings of these companies to further elaborate on the suggested initiatives, aimed at *financial* and *technical enablers* for a more attractive upstream investments climate. The results of these meeting are now under consideration at EL&I." The initial agenda of the working group was set by EL&I.



FIGUUR 12: DECISION-MAKING PROCESS OF THE GAS ROUNDABOUT POLICY (BASED ON EZ, 2009, EL&I 2010, EL&I, 2011)

The platform can be seen as *interactive decision-making* (see De Bruijn et al, 2003; Bueren et al., 2000). In interactive decision-making, the body that is competent to take a decision (EL&I about the policy instruments and objectives) involves other actors in the decision-making. The engagement of actors in the decision-making process works well for spatial planning and other issues where social commitment is required (De Bruijn et al, 2003:35). This form of decision-making enables the different actors to bring forward their streams of problems and solutions, and can therefore be seen as a structured *window of opportunity*. As new *problem streams* (e.g. shale gas) or *solution streams* (e.g. innovation contracts) arise, the agenda of the gas roundabout is dynamic (EZ, 2011). The *streams model* therefore also explain the changing scope of the Gas roundabout policy (see appendix 4). The gas roundabout policy provided involved parties a *frame* to *tag* their problems and solutions, and the platform functioned as a structured window of opportunity to bring forward these problems and solutions.

It can be explained why EL&I decided upon interactive decision-making as mode of the decision-making process. Firstly, the context of the problem – characterized by the variety and closedness of the network with mutual dependencies – urges the need for sufficient *attention and support* from the involved actors for the

policy objectives. Without actively inviting parties to engage in the gas roundabout process, the parties will remain only interested in their own objectives and problem perceptions. This would be problematic as EL&I depends upon these parties for their commitment (support the gas roundabout and make desired investments). Interactive decision-making can reduce network variety and closedness. Organizing the platform creates a tendency towards developing common problem perceptions, support and understanding or even recognition of EL&I's problem perception. Secondly, the wicked nature of the problem urges the need to gather support, but also *substance* aimed at a rich overview of the problem- and solution streams of the parties. As there is *information asymmetry* between the government and the market parties, the government cannot be aware of *all* problems and possible solutions to the issue. Thirdly, when the gas roundabout is seen as an *informal institution*, it would not make sense to unilaterally decide upon a new desired position of the Dutch natural gas value chain. EL&I needs the other parties to mutually discuss and consider *norms* such as government involvement in upstream investments.

FORMAL HIERARCHICAL DECISION-MAKING ON THE POLICY BY EL&I

To what extent do the participants of the platform have influence on the actual policy? Ultimately, it is EL&I who decides upon the instruments. Although the market parties can *consult* the government, they do not have any *production- or blocking power* and the actual decisions are unilaterally taken by the Government. EL&I-official: "Follow-up on the discussed initiatives of the platform was hampered due to political developments, and the fact that more attention from out EL&I was given to innovation contracts. These innovation contracts are also intended to contribute to the attractiveness of the upstream investment climate." This illustrates that the government takes the advices of the platform into account, but is not very committed as other (political) developments have priority.

Two questions can be derived from the two previous sections: were all *relevant* parties invited? This question is important as it was identified that only some oil firms were involved in the platform. How can this be explained? Secondly: is *interactive decision-making* sufficient to reach the necessary support, and to gather the required substance on the problem and possible solutions? The evaluation section of this chapter will examine the applied policy-process (the *platform* and formal decision-making), and will not answer these questions. These questions can only be answered by analyzing the contribution of the gas roundabout policy to the attractiveness of the upstream investment climate by facilitating investments (PART II). This will provide insight in what the *relevant* parties are, and whether the current policy is sufficient to reach support and gather required substance. Therefore, PART III will come back to this.

4.2.2 ANALYZING THE OBJECTIVES OF THE POLICY BY TRACING

The objective of the gas roundabout policy related to upstream investments for the period 2011 and onwards is to: "Continue the efforts aimed at maintaining the level of small-fields production on 30 bcm annually." (EL&I, 2011:4) These *efforts* are the instruments which are presented as derivatives of the gas roundabout policy (see 4.2.3 below). Earlier, this gas roundabout policy objective was also present in other modes such as: "Realize a production level of 30 bcm in 2030 from small-fields, as stated in the ambition of EBN." (EL&I, 2011a:17) Or as: "The Dutch government aims to optimize our role as producing country, by producing as much natural gas as possible from the Dutch natural gas reserves." (EZ, 2009: 14).

This illustrates that the presence of this objective is stable over time, but that it was quantified during the period 2009-2011. This quantification is stemming from the assessment of EBN in 2009 where the 30/30 ambition was presented (EBN, 2009). The objective of the policy therefore adapts to developments in the industry, and even the *problem perception* of one actor. This can be explained by the context and nature of the problem. Firstly, support from EBN and the upstream industry can be generated when the policy incorporates their problem perception. Secondly, substance was added to the policy by the assessment of EBN about the quantified potential of additional upstream production. The *information asymmetry* between the government and the industry requires such adaptation.

The policy objective can also be perceived as very broad. The project-approach of the CoA (2012) state that policy objectives must be specific and measurable ("SMART"), but the process-approach can add nuance to that. Firstly, a broad policy objective (there are numerous ways to realize the 30/30 objective) allows the parties for *goal-stretching* or for *tagging* their problem- and solution streams to the objective, possibly resulting in support. Secondly, a broad objective allows for learning during the process. An example of this learning is the quantification by EBN. Thirdly, a broad objective allows EL&I for *coupling* and *de-coupling* issues. This can be illustrated by the variety of objectives which were coupled to *maximize upstream production* over time. Upstream production contributes to security of supply (AER, 2005:12; EZ, 2006), diversification of gas mix (EZ, 2009:4), economic value and employment (EZ, 2010), a strong position of GasTerra as strong midstream buyer (EZ, 2006), or even knowledge valorization (2011a). From a process-perspective, the broad and dynamic objective can be explained (see 3.2). Though, this broad and dynamic objective might be useful for both EL&I and market parties, what is the *distinctness* of the objective?

Ultimately, the 30/30 objective is not inseparably connected to the gas roundabout policy as the objective to *maximize upstream production* is a core-value of EBN and the Dutch upstream policy since the introduction of the small-fields policy in 1973 (Correlje et al, 2003; Breunese, 2006). It is very likely that EBN would have also formulated the 30/30 ambition without the presence of the gas roundabout policy. It can therefore be concluded that the objective to produce 30 bcm from Dutch small fields in 2030 is independent from the existence of the gas roundabout policy.

4.2.3 Analyzing the instruments of the policy by tracing

The table 4 below indicates the policy instruments which were related to the objective of the gas roundabout policy to contribute to the upstream investment climate. Five of these instruments were actually deployed, and six other instruments were suggested as possible instrument but not deployed, and no reference was made to these instruments in subsequent policy publications.

TABEL4: TRACING INSTRUMENTS OF GAS ROUNDABOUT POLICY 2005-2012 (SOURCE: SEE APPENDIX 5)

Gas roundabout policy publications and scoping of instruments: dynamics of the policy instruments Green marked = deployed from this moment onwards	AER, 2005	EZ, 2006	EZ, 2008	EZ, 2009	Brattle, 2010	EZ, 2010	EZ, 2011a	EZ, 2011	EZ, 2012
Instruments actually deployed									
Small Fields Policy (1973)	X	X	X		X				
Adjustment of the Mining Act to stimulate use of licenses (9-2009)			X	X					
Marginal investment allowance for off-shore (10-2010)			X	X		X	X	X	
Fallow acreage covenant (10-2010)			X	X		X	X	X	
R&D programs / Innovation contracts (1-2012)							X		X
Suggested instruments, not deployed									
Lower administrative burdens permitting/licensing			X			X		X	
Actively approach companies for investments		X							
Improve information distribution to new investors			X						
Technical enablers: coordinated technological enablers applied on a cooperative basis between public and private actors, e.g. championing						X			
Financial enabler: cooperation and coordination of resources to reduce opex						X			
Social enablers: joint public engagement						X			

In general, it can be stated that the development of the instruments was very dynamic. Many initiates were put forward, but also many of them were not translated into actual policy. Part III will attempt to explain this choice and dynamics. The sections below will trace the five deployed instruments, with the aim to place these

instruments in the right context. By doing so, it can be determined what the contribution is of the gas roundabout policy to the existence of these instruments – the *distinctness*.

CONTINUATION OF THE SMALL FIELDS POLICY

Although the *Progress report gas roundabout* (EL&I, 2011:17) and Brattle (2010) present the "continuation of the small-fields policy (SFP)" as achievement of the gas roundabout policy, the SFP originates from 1973 (see Correljé et al, 2003; Correljé and Odell, 2000; Roggenkamp, 2007). Therefore, the existence of the SFP is not an explicit instrument of the gas roundabout policy. It was questioned to what extent the gas roundabout contributes to the *continuation* of the SFP to an EL&I official: "The small fields policy and the gas roundabout policy are seen as two separate policies, both aimed to stimulate small fields production." Therefore, it is most likely that the existence of the SFP and the gas roundabout policy are independent from each other. By tracing this instrument, and interviewing an involved official, the process-approach provided the insight that the existence of this instrument is not dependent on the existence of the policy.

ADJUSTMENT OF THE MINING ACT[2]

The Mining Act was adjusted in 2009 (Tweede Kamer, 2008-2009:31479) with the aim to stimulate a more active use of licenses of exploration, storage and production activities (EZ, 2009a). The result of this adjustment was the marginal investment allowance (art. 68, see below) and the possibility to reduce the licensed area when a license holder does not show significant activity (art. 32). When tracing this instrument, it can be stated that this adjustment was not based on the gas roundabout policy – as was suggested in associated gas roundabout policy publications (EZ, 2009; EZ, 2011) – but originates as response to the evaluation of the Mining Act (PRC, 2007; EZa,2008). This evaluation of the Mining Act was the result of the new Mining Act of 2003. Adjusting the Mining Act – as a result of the evaluation – does therefore not originate from the existence of the gas roundabout policy.

MARGINAL INVESTMENT ALLOWANCE

As stated above, the marginal investment allowance was the product of the adjustment of the Mining Act of 2009, independent of the presence of the gas roundabout policy. It was estimated that this policy instrument would add 21 bcm to the reserves portfolio, contributing €0.6 – 2.6 billion to the Dutch state's revenues (EZ, 2009a:5). The marginal investment allowance was suggested by NOGEPA in 2006, and taken into consideration by EL&I in 2006 (NOGEPA, 2006; EZa, 2006). Also, in the formal announcement of the marginal investment allowance, not reference is made to the gas roundabout policy (EZ, 2009a). Therefore, it is most likely that the existence of this measure is independent from the gas roundabout policy.

FALLOW ACREAGE

Although this instrument was presented as part of the gas roundabout policy (EZ, 2011:7), the Fallow Acreage covenant was signed in response to the adjustments of the Mining Act (NOGEPA, 2008). In 2006, this measure was proposed by NOGEPA (NOGEPA, 2006), and in 2010 the covenant was signed. The driver of this instrument was the Fallow Field policy in the UK (DECC, 2012), the evaluation study of the new Mining Act (PRC, 2007) and the adjustment of the Mining Act.

INNOVATION CONTRACTS

In 2012, the Dutch Ministry formalized the ambition to enforce the competitive advantage and innovation of the Dutch economy by selecting nine prominent industries, which were named 'top sector.' One of these top sectors is 'energy'. Each top-sector published 'innovation-contracts,' being a covenant between the Dutch government (comprising of multiple departments and ministries) and private companies to jointly finance innovation-programs with the objective to strengthen these 'top-sectors' (EZ, 2012:7). One of these innovation-contracts was 'gas,' which was segmented in other 'innovation-contracts,' namely: green gas (50% of budget),

[2] https://zoek.officielebekendmakingen.nl/kst-31479-6.html and http://www.rijksbegroting.nl/algemeen/gerefereerd/1/2/6/kst126685.html

upstream gas (18% of budget), LNG (15% of budget), power to gas and gas to electricity (11% of budget), social embedding (3% of budget) and market-functioning or Gas roundabout 2.0 (2% of budget) (EZ, 2012:14). A total amount of €475 million was budgeted for all the innovation activities and studies over the period 2012-2016, of which €221 million was contributed by private parties (EZ, 2012:6).

The innovation-contract 'resources: upstream gas' has the aim to support the 30/30 ambition by developing and deploying innovative exploration and production technologies (EZ, 2012:4). The upstream innovation contract build on already existing innovation activities and collaborations between the industry, government and knowledge institutes (EZ, 2012:76). These existing programs were continued under the innovation contract upstream gas.

4.2.4 THE GAS ROUNDABOUT POLICY: A POLICY-FRAME

The *distinctness* of the policy objectives and instruments was determined by *tracing*. It can be concluded that all stated *gas roundabout policy instruments* can be derived from already existing policy instruments (SFP) or instruments which are derived from initiatives already in place or developed independent from the existence of the gas roundabout policy (adjustment of the Mining Act, Fallow Acreage, Marginal Investment Allowance, Innovation Contracts). Therefore, the existence of the gas roundabout policy did not *actively* contribute to the existence of these instruments – but nevertheless presents these objectives and instruments as: "achievements of the policy." (EL&I, 2011:7) Can this be explained and justified, and is this a problem?

Ultimately, the extent to which the policy is *satisfying* depends upon the actual contribution of the policy to facilitating investments (see PART II) and whether the policy is satisfying from a *process-perspective* for all *relevant* actors (see 4.3). To conclude this paragraph, and to explain the identified situation, it can be questioned: if the existence of the gas roundabout policy does not contribute to the existence of the policy objectives and policy instruments, then what *is* this policy? And what is the possible *use* of this policy? To answer that question reference is made to BOX 2, where *framing* and associated strategies were described.

The gas roundabout policy, as described and analyzed in this chapter, has many characteristics of *framing.* Related to the first interpretation of a *frame* (see BOX 2), the *gas roundabout* can be seen as a *metaphor* for the desired situation of the Dutch natural gas value chain. Korsten's (2008) definition of a *policy-frame* – being a paradigm, a vision or perspective – well reflects the vision of the AER (2005) and EZ (2006), which were the prelude of the gas roundabout policy. It combines *policy-frames* such as liberalization, the Dutch production function, security of supply, and competitive advantages. As all these individual frames are interrelated, and multiple parties can *identify* themselves with this 'mutual frame', the 'gas roundabout' can be seen as an effective frame according to Korsten (2008). This frame served as a guidepost for persuading and acting for many parties in the natural gas value chain. It placed a *spot on the horizon* for these parties, and functions as a perspective from which an amorphous, ill-defined problematic situation can be made sense of and acted upon. This *frame* was accepted – and therefore successful according to Korsten (2008) – as can be illustrated by the presence of this frame in the annual reports of the four most important actors of the Dutch natural gas value chain (see figure 13 below).

Besides the *metaphor* of EL&I´s vision, the *frame* ´gas roundabout´ also has another function. This relates to the second interpretation of framing, namely *issue-framing.* The *frame* gas roundabout has a very broad, open, adaptive and dynamic character as illustrated in 4.1. These characteristics of the *frame* were used by EL&I and the other actors in multiple ways to realize certain *process-objectives.*

Firstly, the broad nature of the frame enabled EL&I to involve actors along the value chain, and create a *common issue*. Although the Dutch natural gas value chain is technically, economically and institutionally interrelated, most issues affect only one (sub-) part of the value chain such as upstream investments, transmission-system expansion or downstream green-gas injection. The gas roundabout is a frame which brings together all these actors, who would otherwise interact to a lesser extent. The frame stimulates parties to think *beyond* their own issues. This adds to the need of a network which is characterized by a high variety. Important

for EL&I, the gas roundabout enables them to put forward their particular issues (security of supply and competitive advantages), which would otherwise not have gained interest from the actors.

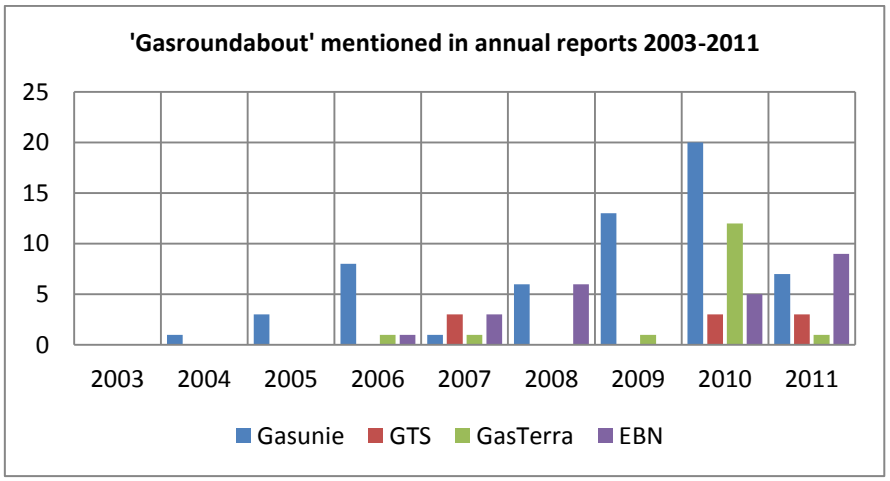


FIGURE 13: GAS ROUNDABOUT IN ANNUAL REPORTS (SOURCE: ANNUAL REPORTS GASUNIE, GTS, GASTERRA AND EBN 2003-2011)

Secondly, the frame creates a *sense of urgency* to re-think the position of the Dutch natural gas value chain. Parties are stimulated to question how they can contribute to the *gas roundabout*, and what the *gas roundabout* might have to offer them. Because it is not pre-defined what this gas roundabout is, it gives the parties a *window of opportunity* to bring forward their problems and solutions, related to the gas roundabout. This counts for EL&I, who can *tag* solutions such as *green-deals* and *innovation contracts* to the gas roundabout.

Complementary to that, it gives other actors a *frame* to *tag* their own problems and solutions to. This *open* and *adaptive* nature of the frame is very suitable for the *closedness* of the network, where all the different parties now have the chance to put forward their individual projects, problems and solutions as part of the *gas roundabout.* Alternatively, when the gas roundabout policy would *not* be open and adaptive, parties would probably resist because of this closedness. The nature of the frame allows for *goal-stretching* and *coupling and de-coupling* of issues. Table 4 clearly indicates the coupling of possible policy initiatives, and de-coupling of some of these initiatives. Therefore the *frame* successfully adds to the needs of the network regarding this. Moreover, this *sense of urgency* can be used by EL&I to engage and interact with the industry – as was illustrated by the platform. It supports EL&I to further develop or reshape their *policy-frame* with substance and support.

Perceiving the gas roundabout policy as a *frame* adds to our understanding why existing policy objectives and instruments are *tagged* as new policy, and why the scope of the policy is so dynamic. The *frame* ´gas roundabout´ has the potential to meet certain *process-objectives* of actors as explained above. Also, the *frame* provides a vision or *informal institution* for the actors. Therefore, the question ´what *is* the policy´ can be answered by looking at the policy as a frame to (i) start the process as it creates a *sense of urgency*, (ii) raise interest for EL&I´s problem perception, (iii) provide a common-problem for the *variety* network, involving many actors which are stimulated to think beyond their own problem perception, (iv) *tag* problems and solutions of individual actors, adding to the need of the *closed* network and resulting in interest and support for the gas roundabout, (v) allow EL&I to *tag* existing objectives and measures, possibly resulting in support and interest of other actors for these objectives and measures.

The frame is not used as an *active rhetoric frame*, the third interpretation of framing (De Bruijn, 2012). The gas roundabout frame is both a *policy-frame* and an *issue-frame.* The question remains whether this *frame* actively contributes in setting the right regulatory regime for upstream investments. How is this *frame* be related to that question? This will be reflected upon in the conclusion of this chapter (4.4).

4.3 *EVALUATING* THE GAS ROUNDABOUT POLICY FROM A PROCESS-PERSPECTIVE

From a process perspective, a policy is *monitored* rather than strictly *evaluated*. Nevertheless the term evaluation will be used. As identified in the previous section, the policy instruments and objectives of the gas roundabout policy do not contribute to the existence of the objectives or the instruments. However, the gas roundabout policy can still be positively evaluated from a process perspective when the policy meets the criteria of De Bruijn and Ten Heuvelhof (2008). According to De Bruijn and Ten Heuvelhof (2008), the outcome of the *network* decision can be evaluated by looking at the satisfaction of involved parties (EBN, NAM, GDF, Wintershall, Centrica), problems which have been solved, learning of the parties, the extent to which long lasting relations have been developed and the fairness of the process. These criteria will be addressed below. Because no information was available about these criteria, interviews with the relevant actors are conducted for this study (see appendix 10). Although De Bruijn and Ten Heuvelhof (2008) merely focus on the parties involved in the process, this study has interviewed a broad range of actors, of which some were involved in the platform. This is decided because the policy has an effect on all operators, and not only on those involved in the platform. Again, this evaluation does not emphasize on the contribution of the gas roundabout policy to the attractiveness of the upstream investment climate, but on the contribution of the gas roundabout policy to the regulatory regime as such – evaluating the decision-making *process*: the *platform* combined with hierarchical decision-making by EL&I as described in 4.2.1.

SATISFACTION OF PARTIES

De Bruijn and Ten Heuvelhof (2008) state that the satisfaction of the parties must be determined about the outcome of the process. The decision-making process within the scope of this research comprise two aspects: the outcome of the formal decision-making process – comprising the earlier described gas roundabout policy instruments – and the outcome of the platform. Based on the conducted interviews, it can be concluded that the level of satisfaction is very depending on the *problem perceptions.* It is therefore challenging to unambiguously determine the overall satisfaction of parties. General conclusions can be made though.

SATISFACTION ABOUT THE POLICY INSTRUMENTS

Of the interviewed parties, all were satisfied about the presence of the small-fields policy because it takes away volume-risk due to GasTerra's off-take guarantee. When a liquid market matures, volume-risk can also be provided by the market. (Wintershall, ONE, NPN) Moreover, Wintershall pointed at the added value of the *opt-out arrangement*: "The *opt-out agreement* leads to potential third party sales for committed gas, whereas uncommitted gas can already be sold to third parties or GasTerra." Some parties insist on an adjustment of the policy, aimed to mitigate tail-end production and tough reservoir gasses, rather than a simple continuation of the present policy.

The satisfaction of the marginal investment allowance differs among on-shore and off-shore firms, as on-shore firms do not benefit from this measure (Vermilion, NPN). Off-shore firms see this measure as a very important and attractive instrument of the policy (Wintershall, ONE, Centrica). The firms are partly satisfied about the adjustment of the Mining Act and the Fallow Acreage covenant. This is because the covenant is a non-binding agreement, and the data provision by EL&I about available fallow fields is insufficient. The idea behind Fallow Acreage is seen as satisfying to some extent, but the implementation is seen as insufficient by most of the parties. Most of the interviewed firms were not aware of the innovation contracts, or not convinced about a possible positive effect on the attractiveness of the upstream investment climate. The interviews pointed out that the current set of policy instruments is insufficient to mitigate the current and expected future issues. This will be more in-depth addressed in PART II. Depending on their problem perception, many alternative problems and possible solutions were proposed by the interviewed firms. In general, the Dutch upstream industry is attractive according to the firms, but many issues remain unresolved.

SATISFACTION ABOUT THE GAS HUB CONSULTATIVE PLATFORM

The platform identified a part of these unaddressed issues and possible solutions. The participants were satisfied about their recommendations, as this is the negotiated result of their cumulative problem perception.

Involving firms in the platform enriched the substantive insight in the problem and possible solutions, and broadened a possible *action agenda.*

Because the follow-up on the recommendations of the platform is in progress, the parties can be expected to be less satisfied about the implementation of their recommendations. Also, as the number of involved parties is very limited, it is questionable how *representative* the *negotiated problem perception* is. Interviews with firms identified many other issues and possible solutions, which were not addressed by the platform or by the policy makers. PART II will provide more insight.

In general, it can be concluded that participating parties are limitedly satisfied about the outcomes of the decision-making process, because the implementation of their recommendations is lacking, and that non-participating parties are not satisfied because their issues and solutions were not incorporated in the decision-making process.

SOLVED PROBLEMS BY POLICY

Although many issues were not mitigated by the policy (as will be extensively elaborated in PART II), some problems were solved by the policy instruments. The problem of license owners which do not actively use their license – resulting in sub-optimal utilization of the subsurface – was seen as a major problem during the evaluation of the Mining Act (PRC, 2007). This problem was partly mitigated by adjusting the Mining Act and the Fallow Acreage covenant. Also, the problem of many sub-economical contingent resources was limitedly mitigated by the policy as 14 projects were granted for this investment allowance (EBN, 2011). Therefore, *some* problems were actually solved by the policy instruments.

LEARNING OF THE PARTIES

Parties learn when they are being confronted with new issues and information, which may lead to adopt another point of view. For example, the parties have learned from the UK case that a Fallow Field regulation can increase the level of activities. Also, the participants in the platform have learned from the problem perceptions of their peers. Because only a limited number of parties were involved, the learning was limited. Because the proposed measures of the platform are not (yet) addressed by EL&I, no statement can be made about the learning of EL&I during the platform. In general, the dynamics of the policy – incorporating market, political and industry development – shows that the policy makers are learning to some extent as well.

RELATION-BUILDING OF THE PARTIES

Parties have build relations when they are willing to cooperate and negotiate in the future. Establishing the platform was therefore an important instrument. When EL&I properly succeeds the recommendations, the parties can be expected to participate in future platforms. Because all operators committed to innovation contracts, the process resulted in a unique first cooperation between all operators. This can become an important prelude for future cooperation between the firms according to Pinto Scholtbach.

FAIRNESS OF THE PROCESS

The process is fair when all relevant parties are involved, all parties have sufficient chances to realize their interests, the core-values of the parties are respected and the views of different parties were listened to. (De Bruijn and Ten Heuvelhof, 2008:87). EL&I aimed for an open process when establishing the platform, but only invited a limited number of parties. The majority of the firms was therefore not involved in the process, and their views were not listened to. Therefore, it can therefore be stated that the process was not very fair.

How can this be explained? Combined with insight from PART II, PART III will determine whether the contribution of the gas roundabout policy to the regulatory regime – as analyzed and evaluated in this chapter – contributes to the attractiveness of the Dutch upstream investment climate so that the objective to produce 30 bcm from small-fields in 2030 can be realized.

4.4 CONCLUSION

Based on the analysis and evaluation of the gas roundabout policy, this paragraph will conclude and answer the research question of this chapter.

The gas roundabout policy is a policy which can best be approached from a process perspective

Because of the mutual dependent relationship between EL&I and market parties for realizing their different objectives, the problem context can be characterized as a network of actors with different interests, roles and power. The different problem perceptions ask for a *process approach* to decision-making, and a common understanding about a possible desired situation. By establishing the consultative platform and allowing for dynamics in the policy scope, the gas roundabout policy recognized the importance of *interactive decision-making* from a process approach. With this regard, the gas roundabout policy contributed positively to the decision-making process of the regulatory regime to some extent.

The content of the policy is influenced by the ongoing decision-making process, dynamic industry and market developments, path-dependent informal institutions and external events. Because of the nature of the problem, the gas roundabout policy has proper eye for these dynamics. Over the years, the policy content incrementally changed due to these influences, and can best be characterized as a dynamic *multi-issue* policy which is open for adaptations. Decisions about policy instruments are taken unilateral by EL&I, but established in some dialogue with some other actors. Because the policy is aimed at long-term objectives, depends on third parties, has no predefined content, start or end, evaluating the policy as a *project* is not suitable. Limitations of Chamber of Audits (2012) and Brattle (2010) can therefore explained (see box 3). The policy cannot be properly evaluated without taking into account the long-term time-horizon, external developments and the multi-actor context.

The contribution of the gas roundabout policy to the regulatory regime is mainly a *frame* which enables EL&I and other actors to realize process-objectives

The policy objective to realize a production level of 30 bcm in 2030 is derived from the problem perception of EBN. Also, the objective to maximize the level of small-field production exists since the mid-70s, and is no new objective of Dutch energy policy. Other policy objectives, related to the development of storage- and LNG-facilities are more closely related to the liberalization and subsequent ambition to position the Netherland as gas roundabout of Northwest Europe. The involvement and problem perception of actors, but also external developments in the industry and policy (e.g. innovation contracts) drive the existence and content of the policy objectives, scope and content.

The gas roundabout policy did not contribute to the existence of the policy instruments, as was identified by *tracing* these instruments. All instruments are derived from existing measures or the evaluation and adjustment of the Mining Act; developments which would most likely also have occurred without the existence of the gas roundabout policy. The policy adopted these instruments and has presented these instruments as *achievements* of the gas roundabout policy. This is, however, not the case as the gas roundabout policy can best be seen as a *frame* in which all these separate initiatives were *tagged.* It was pointed out that this *frame* has multiple advantages for the *process,* and therefore contributed to the regulatory regime positively. The gas roundabout policy was evaluated from a process-perspective. It was concluded that not all relevant parties were involved, making the process limitedly fair. However, *some* problems were solved, some relations were build and some learning occurred.

It must therefore be concluded that the contribution of the gas roundabout policy to the regulatory regime is very limited, with only positive contribution being the *frame* in which the policy is presented. The fact that the gas roundabout policy is mainly a frame of existing initiatives, comprised a sub-optimal decision-making process, and did not involve all actors will only be a problem when the *contribution* of the gas roundabout policy to the attractiveness of the upstream investment climate is sub-optimal. This will first be addressed in PART II. Conclusions from PART II will be used in PART III, where the interaction between the two parts will be discussed.

4.5 REFLECTION ON THE THEORY

This chapter applied different theories with regard to policy making, analysis and evaluation. By opposing two different views – the project versus the process approach, see table 3 – clear distinction could be made between two perspectives on policy. By analyzing the most important elements of the policy, the policy can be placed in the most relevant perspective for analysis and evaluation. The theories did not only result in comprehensive insight to the policy, but also enabled this study to place two existing reports in perspective. The concepts of *wicked problems* and multi-actor networks are often overlooked by classical approaches, but were included in this study effectively by applying the process-approach theory. Moreover, by combining two theories on *framing* in box 2, this concept could be placed in a broad perspective in section 4.2.4. Framing helped to answer some questions which came out the analysis of the policy. Lastly, the process-approach to policy evaluation proved to be a useful guideline to evaluate the policy on some important aspects. When the project-approach would have been applied to the gas roundabout policy, no *explaining power* would have been deduced from the *frame,* the network and the actors. A project-approach would not have resulted in the conclusion that the policy is mainly a frame to which parties can attach or *tag* their problems and solutions, but to an oversimplified representation of the policy (see Brattle, 2010; CoA, 2012). However the research question of this chapter was answered, some limitations of the applied theories will be addressed below.

First, the applied evaluation criteria are theoretically most applicable for outcomes of a *negotiated* process (De Bruijn and Ten Heuvelhof, 2008). In the case of the gas roundabout policy process, it is questionable whether the outcomes of the platform were actually negotiated. The platform was not intended to negotiate on outcomes, but rather to consult EL&I about possible problems and solutions. This in opposition to a *classical* process-design or network as described by De Bruijn and Ten Heuvelhof (2008), where the outcomes are the product of giving-and-taking and negotiations. This made it hard to strictly apply the criteria of De Bruijn and Ten Heuvelhof (2008). Therefore, 4.3 evaluated not strictly the outcomes of the *negotiation-process* for the *involved actors* only, but more the outcomes of the *overall policy* for *all* affected actors in the hybrid decision-making process (see 4.2.1). Also, the criteria (e.g. learning, relation-building) are hard to measure and verify when the observer is not involved in the process. This was partly succeeded by interviewing some of the involved parties.

Secondly, the process approach does not enable to analyze the actual contribution of the policy to the problem. Although it was explained in 3.2.2 that this can be challenging - because of e.g. long-term effects, dependency on other actors, phenomena like framing and tagging - monitoring the process could become more insightful when it would move *beyond* the criteria that *some problems* can be solved. By extending this criterion to *how does the policy contribute to solving problems* (e.g. facilitates investments), monitoring can become more effective on substantive grounds. In such a case, the policy analyst can still place the policy in the right perspective (project or process) but can also take the next step by determining what the contribution of these *policy-outcomes* is to the problem. Such criterion does not attempt to evaluate the *effects* of a policy, as is case with the project-approach, but can still be of added value to the evaluation of the policy by not only addressing the outcomes of the process, but also the *contribution* of those outcomes to the problem.

Thirdly, it is questionable whether evaluating the satisfaction of *involved parties* is relevant when only *some* parties are involved. The theory assumes that not involving parties is a strategic choice (De Bruijn and Ten Heuvelhof, 2008), but in this situation it was not the case. Apparently there are also other reasons why parties are included or not. This can probably be omission, power, path-dependency or other.

Fourthly, the theory does not provide guidelines to evaluate *framing.* To evaluate a policy which is mainly a frame, it is relevant to question what the contribution of the frame is to the problem (e.g. attractiveness upstream investment climate), in *addition* to the effect of the frame on the *process*.

In general, all the four limitations of policy analysis require more insight in the research domain from another perspective. This perspective can be technical, economic, social or other. These perspectives might answer

such residual questions and provide additional insights. So in general, there is a need for an analysis framework which includes strategies such as framing, addresses the policy process of such hybrid modes of decision-making, and includes the *contribution* of the policy and the interaction of the policy with the research domain and actor-network. PART III of this research will attempt to develop such an *integrated analysis framework*.

The main questions which remained unresolved after this PART are:

- How can it be explained that the process was only limitedly fair? Were all *relevant* parties involved in the process?
- What is the contribution of the *frame*, and what are possible pitfalls of a *frame*?
- Was *interactive decision-making* a suitable process to involve actors?
- What could be a more comprehensive framework for policy making and analysis, adding to the identified theoretical needs?

PART II:

FACILITATING INVESTMENTS?

5. TOWARDS A THEORETICAL PERSPECTIVE TO ANALYZE UPSTREAM INVESTMENTS AND POLICY

This chapter aims to answer the question:

How can the contribution of the gas roundabout policy to the attractiveness of the Dutch upstream investment climate be analyzed?

The attractiveness is defined as the extent to which firms are willing to invest in the Dutch upstream industry. The gas roundabout policy aims to contribute to this willingness by actively facilitating investments. Section 2.4 concluded with an overview of contributing factors of the gas roundabout policy, these are again presented in figure 13 below. Although PART I identified that the existence of these factors is independent from the existence of the gas roundabout policy, the contribution of these factors to the attractiveness of the Dutch upstream investment climate can still contribute to the attractiveness of the investment climate, meet the policy objectives and satisfy the parties. Therefore, this chapter has the objective to develop a theoretical body which can be applied to determine the contribution of those factors to upstream investments by firms, and the associated attractiveness of the upstream investment climate. The theoretical body must be capable to make specific predictions about upstream investments made by firms, and which elements are relevant to analyze to make such predictions. This theoretical body must also take into account the contribution of policy to these upstream investments.

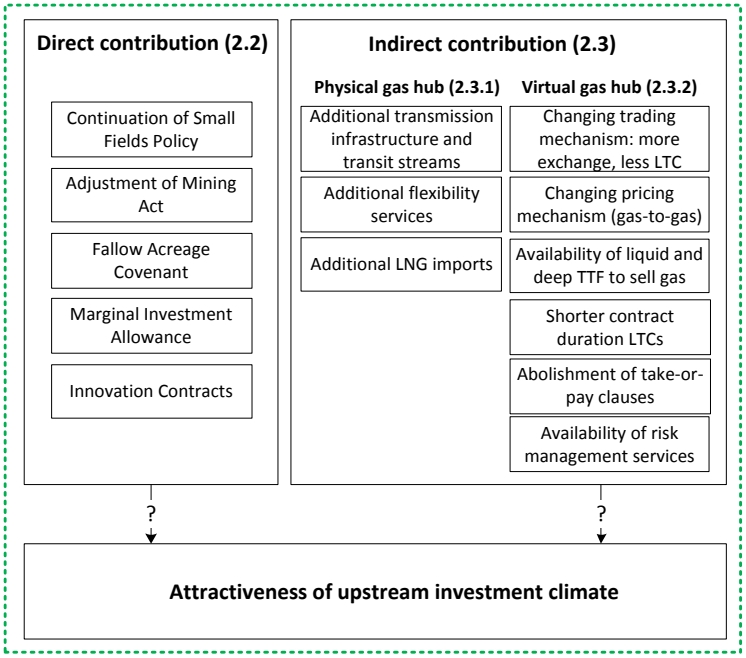


FIGURE 13: SCOPE OF PART II

As it are firms that decide to invest and make judgments upon the attractiveness of the investment climate, this study must place the firm central to its analysis. Kanterelis (2007) book "Theories of the firm" state that: "The theory of the firm consists of a number of economic theories that describe, explain, and predict the nature of the firm, including the existence, behavior, structure and relationship to the market." (Kanterelis, 2007)

To answer the research question, a theoretical body must be chosen or developed to analyze and predict the investment behavior of firms in the Dutch upstream industry. However, as there are a dozens of theories of the firm, the next paragraphs will elaborate on a structured approach to select or develop an appropriate theory, or set of theories, suitable for answering the research question of this study (5.1-5.3). These considerations will guide the development of the analysis framework and theory (5.4-5.7).

5.1 DEVELOPING A THEORETICAL BODY: FRAMEWORKS, THEORIES AND MODELS

Scholars such as Coase (1937) and Williamson (1998) describe *firms* as a set of *institutional* governance arrangements. North (1994) characterizes an *institution* as: "Human devised constraints that structure human interaction. They are made up of formal constraints, informal constraints and their enforcement characteristics. Together they define the incentive structure of societies and specifically economies." (North, 1994: 360) Institutional analysis is therefore elementary to answer the research question. In order to develop and conduct such an analysis, reference is made to articles of Elinor Ostrom (Ostrom, 1999; Ostrom, 2005; Ostrom, 2011). Ostrom states that "The study of institutions depends on theoretical work undertaken at three levels of specificity that are often confused with one another. The essential foundations are frameworks, theories, and models. Analyses conducted at each level provide different degrees of specificity related to a particular problem." (Ostrom, 2011:8). See box 4 below for Ostrom's distinction between three levels of analysis.

BOX 4: OSTROMS'S DISTINCTION BETWEEN THREE LEVELS OF (INSTITUTIONAL) ANALYSIS

Frameworks

"The development and use of frameworks are the most general forms of theoretical analysis. Frameworks identify the elements and general relationships among these elements that one needs to consider for institutional analysis and they organize diagnostic and prescriptive inquiry. They provide a general set of variables that can be used to analyze all types of institutional arrangements. Frameworks provide a metatheoretical language that can be used to compare theories. They attempt to identify the universal elements that any theory relevant to the same kind of phenomena needs to include. Many differences in surface reality can result from the way these variables combine with or interact with one another. The extent of shared information available to actors needs to be thought about when asking theoretical questions as well as the flow of activities and who pays what benefits and receives what costs. Thus, the elements contained in a framework help analysts generate the questions that need to be addressed when they conduct an analysis." (Ostrom, 2011:8)

Theories

"The development and use of theories enable the analyst to specify which elements of a framework are particularly relevant to particular questions and to make general working assumptions about the shape and strength of these elements. Theories make assumptions that are necessary for an analyst to diagnose a specific phenomenon, explain its processes, and predict outcomes. Multiple theories are usually compatible with one framework." (Ostrom, 2011:8)

Models

The development and use of models involve making precise assumptions about a limited set of variables and parameters to derive precise predictions about the results of combining these variables using a particular theory. Logic, mathematics, game-theory models, agent-based models, experimentation and simulation, and other means are used to explore systematically the consequences of these assumptions on a limited set of outcomes. Multiple models are compatible with most theories." (Ostrom, 2011:8) "One needs a common framework and family of theories in order to address questions. Particular models then help the analyst to deduce specific predictions about likely outcomes of highly simplified structures. Models are useful in policy analysis when they are well tailored to the particular problem at hand. Models can be used inappropriately when applied to the study of situations that do not closely fit the assumptions of the model." (Ostrom, 2011:9)

The required level of specificity of the problem-in-question determines whether a framework, theory or model would be appropriate for the analysis. A framework can help this study to identify the elements and general relationships among these elements. This framework could be the basis of an analysis on 'the contribution of the gas roundabout policy to the attractiveness of upstream investments' as it can provide a general set of variables for such an analysis. These variables can be generated from literature review about upstream investments and interviews with relevant stakeholders such as EBN, operators and the Ministry of EL&I. Based

on this framework, possibly relevant theories can be compared, and specific questions that need to be addressed for answering the research question can be generated. The elements of the framework which are *particularly relevant* to explain and predict the 'attractiveness of upstream investments for firms' can be analyzed by using particular *theories*. Using models is less relevant for this study because the nature of the research questions is general. This study is mainly interested in the general explanations and predictions about the 'attractiveness of upstream investments for firms' related to the gas roundabout policy in an *exploratory* way. When this research would be delineated to derive precise predictions about the results of variables such as one particular policy instrument on a well-defined particular business-case, a model would be more applicable.

Section 5.4 will develop a *framework* for analysis, by identifying the elements and general relationships among these elements one needs to consider to explain and predict the contribution of policy to the attractiveness of upstream investments for firms. Section 5.5 will establish a *theory* which can be used to explain and predict the *contribution of the gas roundabout policy to the attractiveness of upstream investments for firms.* This will be done by describing which of these elements are particularly relevant to explain and predict the contribution of the gas roundabout policy.

5.2 SELECTING THEORIES: METHODOLOGICAL INDIVIDUALISM, HOLISM AND INTERACTIONISM

According to Ostrom (2005), a theory is "selected", or perceived as "relevant", when it addresses the "most relevant" elements and relations among elements which need to be explained and predicted to answer the research question (potentially deduced from a developed framework for analysis). This raises the question: 'can all theories be applied, as long as they address the relevant elements and relations among these elements?' Moreover, when there are multiple theories which address the relevant elements and relations among these elements, how can be determined which theory is the "most" applicable? And when there is not one single theory which addresses all relevant elements and relations, how can theories be combined? The next section will elaborate on combining theories (5.3), this section will emphasize on selecting relevant theories.

According to Groenewegen and Vromen (1996) a theory has two dimensions: *issues* and presuppositions or *conditions*. The issue that a theory addresses can be seen as 'the aspect of the set of phenomena' (Groenewegen and Vromen, 1996:373). For example, theories of the firm address issues such as the *behavior* and *structure* of firms. When *behavior* and *structure* of firms are the issues that need to be explained or predicted by a theory in order to answer a particular research question, the theory of the firm is relevant because it addresses these specific elements and relations among these elements. The second dimension relate to the conditions or presuppositions to which the theory subscribes, of which the *methodology* is one of the most important. The three categories of methodologies are described in box 5 below

BOX 5: METHODOLOGIES OF SCIENCE adapted from Groenewegen et al. (2010)

Methodological individualism

In the case of methodological individualism the explanation of structures is reduced to individuals. Individual and purposeful action is the only factor that counts. Individuals are assumed to have specific characteristics like full rationality and follow clear rules to maximize profits or minimize costs. These characteristics are given and constant, that is to say that the characteristics of the individual do not change during the analysis due to the influence of changes in other parts of the system. The preferences and characteristics of the agents are not explained by the structures of the system. Structures can be institutional, economical, technical or other.

Methodological holism

In the case of methodological holism the explanation is reduced to the social whole, the structure. Social structures are created intentionally by individuals or emerge as unintended outcomes of their interactions, but according to the holistic approach the social structures have their own specific characteristics, which cannot be

reduced to the characteristics of individuals. In other words: structures have an identity of their own which cannot be explained through the behavior of individual actors. Moreover, structures have a dynamic of their own and determine the behavior of the individuals. Individual actors are captured by the structures and in the extreme their behavior is completely determined by the structure.

Methodological interactionism

The two extremes of methodological individualism and methodological holism have been strongly criticized: there will often be interaction between individuals and structures. The environment has an influence on individuals and modifies their way of thinking, their norms and their values. The institutions in society create the habits of people and guide their behavior. Simultaneously the actors influence society through both their intentional and unintentional behavior. Actors perpetuate the institutions and give direction to the institutional dynamics. In short: the structures of society are both the conditioning factor and the outcome of human agent.

With regard to the dimension of conditions or presuppositions, a theory is relevant to analyze a particular issue when the theories' conditions or presuppositions correspond with the conditions or presuppositions in the actual research domain, or '*real world'.* In section 5.5, theories will be chosen to analyze upstream investments. Therefore it must be determined what the *research domain's* conditions or presuppositions are of upstream investments, in terms of the three described methodologies and other conditions or presuppositions of those theories.

5.3 COMBINING THEORIES: MONISM VERSUS PLURALISM

When the most relevant elements are identified from the framework, it must be determined which theory or theories must be used to explain and predict the contribution of the gas roundabout policy to upstream investments. The previous section has elaborated upon criteria which make a theory *relevant*: the concerned issues and conditions of the theory related to the research domain. This section will describe how different theories can be combined by referring to Groenewegen and Vromen (1996), who address *theoretical pluralism.* This concept is relevant in developing a pluralistic approach to explain and predict issues of economic organization, when one single theory is too limited to explain and make predictions about all of the most relevant elements. "If different theories can be relevant, the question arises as to how, in a pluralistic approach towards questions of economic organization, the different theories can be combined. […] How many of the identified hard-core propositions need any two theories (or series of theories) have in common with each other to belong to one and the same scientific research program? All of them? Or just a few of them? And must the shared propositions be exactly identical, or are some minor modifications allowed for?" (Groenewegen and Vromen, 1996:366)

THEORETICAL MONISM VERSUS THEORETICAL PLURALISM

Groenewegen and Vromen (1996) explain that theoretical *monism* is the doctrine that there exists one and only one true theory for any set of phenomena. According to theoretical monists the overriding goal or aim of science is to find that unique, true theory. The existence of several different theories (addressing the same set of phenomena) can be tolerated by theoretical monists only as a temporary state that has to be overcome eventually. By contrast, theoretical *pluralism* approves of a plurality of irreconcilable theories for a given set of phenomena not just as a transitory but as an enduring state. This approval is not based on the pragmatic consideration that our procedures of scientific scrutiny fall short of singling out one uniquely true theory. It is grounded in the principal reason that any single theory inevitably gives a partial account. No single theory is thought to be able to give a complete account of some set of phenomena of its own. Any theory involves abstractions, idealizations, and perhaps even caricatures. The leading idea in theoretical pluralism is that our understanding of phenomena can be enhanced if we entertain several theories instead of just one, at least in so far as the theories do not contradict each other. If theories, or their central claims, contradict each other, then their co-existence is unacceptable. Theories may conflict with each other in what is seen as the central explanatory variable for some given issues, but these theories cannot be simultaneously accepted (Groenewegen and Vromen, 1996:371).

THEORETICAL PLURALISM

"A plurality of theories could be welcomed for a combination of a pragmatic and a principal reason. The pragmatic reason is that formulating an all-embracing, all-condition theory is infeasible. The principal reason is that any of these theories is applicable under different conditions. If some theories can be assumed to be applicable under different conditions, they can be said to be *complementary*. In combination these theories then can be said to give us a riches understanding of some set of phenomena than any of them does in isolation." Furthermore, different theories may address different aspects of phenomena (issues). Such theories can also be seen as *complementary* rather than conflicting or supplementary (Groenewegen and Vromen, 2006:373). "Theoretical pluralism should be embraced only if we think we have good reasons to believe that at least one of the theories gives a better account of the issues it was devised to address than any of the other theories that can be extended to this issue." Groenewegen and Vromen (1996) thus identified two types of theoretical pluralism, related to the issues that the theory addresses, and the conditions under which the theory is applicable, as identified in the table below for the example of transaction costs economics with a limited number of other theories:

TABLE 5: DIAGRAM OF THEORETICAL PLURALISM , TCE EXAMPLE (SOURCE: ADAPTED FROM GROENEWEGEN AND VROMEN (1996:375)

Issues / **Conditions**	**Same**	**Different**
Same	Property rights theory	Evolutionary competence approach
Different	Power-based approach	Any theory that addresses other issues under different conditions

The above mentioned considerations can guide a combination of theories as the theories must be compared on the following characteristics:

- Issues addressed by the theories;
- Conditions under which the theories are applicable;

With the constraints related to:

- Extendibility of the theories towards issues addressed by the other theories, when theories are combined which address different issues.
- Contradiction of the explanatory variables.

Paragraph 5.4 will develop a framework for analysis, and paragraph 5.5 will define which theories are relevant for the analysis. When it will be found that multiple theories are relevant, paragraph 5.6 will define whether multiple theories are needed, and can be combined in order to generate a rich understanding for explaining and predicting the contribution of the gas roundabout policy to upstream investments.

5.4 DEVELOPING A FRAMEWORK FOR ANALYSIS

In line with Ostrom's definition of a framework, this paragraph will develop a framework which can be used to analyze the contribution of the gas roundabout policy to the attractiveness of upstream investments on the highest level of specificity. (Ostrom, 2005) The framework consists of all identified elements and general relationships among these elements that are needed to answer the research question. The first objective of this framework is that is can be used to compare theories in the next paragraph (5.5). A second objective of this framework is that is helps to formulate relevant questions for the analysis which can be addressed by the theories, in the application of the theory in chapter 6. Frameworks have a general and broad nature, the elements and relations among these elements which build the framework are therefore of different nature: social elements, physical elements, natural elements, physical relations, economical relations, institutional relations and so on. The boundaries of the framework are determined by the boundaries of the problem area of the research domain. The problem area and research questions are the starting point of the development of the framework.

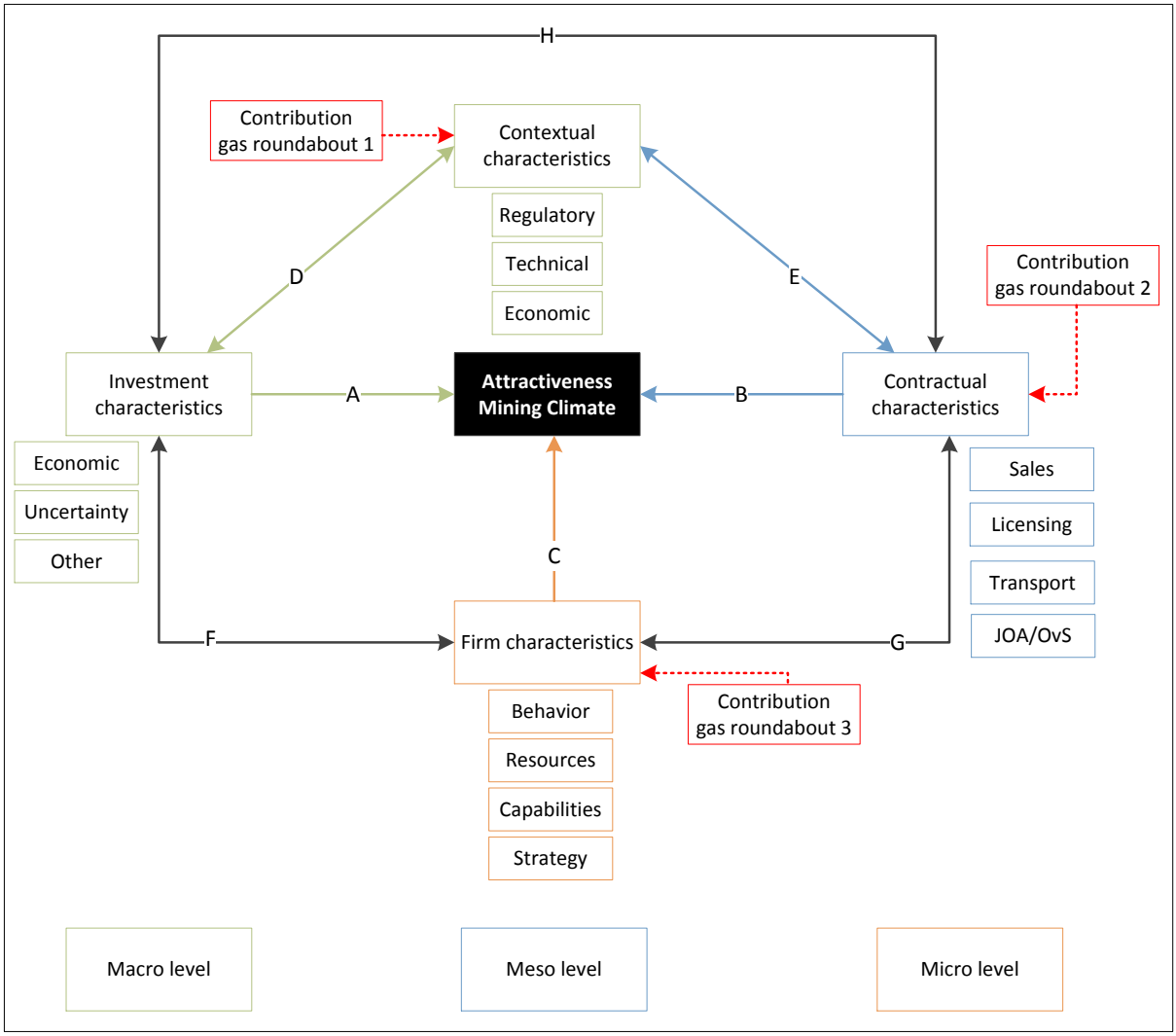


FIGURE 13: THE "METHODOLOGICAL INTERACTIONISTIC FRAMEWORK FOR ANALYSIS"

The framework above will be briefly described below. As indicated, there are three levels containing different elements (green, blue and orange boxes), relations between the elements (A-H) and the contribution of the gas roundabout policy to these elements (red boxes). The elements and relations among these elements determine the attractiveness of the upstream investments climate for a firm (middle black box). The gas roundabout policy aims to contribute to these elements, as will be described below.

5.4.1 CONTEXTUAL ELEMENTS AND RELATIONS

Technical, regulatory (or institutional) and economic elements determine the context in which upstream investments take place. Important technical elements are the size of the prospects, availability of infrastructure and the type of fields. Institutional characteristics refer to the *formal institutions* such as the Mining Act and the Gas Act, licensing and permitting procedures, and taxes, state-profit-share and other financial instruments, policy and regulation. Economic elements relate to both upstream and midstream elements. Upstream economic elements are the availability and tariffs or rigs, personnel and other contractors-resources, and the access conditions and tariffs to platforms, pipelines and other facilities. The presence and behavior of other firms is also part of the upstream economic context. Midstream elements comprise the wholesale trading mechanism, the liquidity of the exchange, the availability, structure and behavior of the buyers, demand for natural gas and the role of natural gas in the overall energy mix. These contextual elements are internally interrelated, but more importantly have an effect on the macro and meso level of the framework.

Relation D indicates the relation between this context and the investment characteristics. Examples are the effect of taxes and, the availability of infrastructure and the availability of prospects on the investments

characteristics. The other way around, investments have an impact on the context as for example new investments increase the availability of infrastructure. **Relation E** indicates the relation between the context and the contractual elements. This relation is substantiated by Williamson (1998) who describes how contracts (*institutional arrangements*) depend on formal institutions such as laws and regulation. The other way around, the institutional arrangements structure the market to which the natural gas is sold.

The gas roundabout policy aims to contribute to this context by direct and indirect contributing factors (see 2.4). The development of a virtual and physical gas hub aims to re-structure the midstream economic context. Moreover, the continuation of the small fields policy, the marginal investment allowance, fallow acreage and the adjustment of the mining act are all aimed to affect the upstream economic- and institutional context. The contribution of the gas roundabout policy to this context will therefore contribute to the relations of this context with the macro and meso level of the framework (**contribution gas roundabout 1**).

5.4.2 MACRO LEVEL: INVESTMENT CHARACTERISTICS

The macro level concerns the elements determining the investment characteristics. The most important are the economic elements, determining the viability of the investment in terms of *expected monetary value* (EMV, see WoodMackenzie, 2000) or *net present value* (NPV). These economic elements determine the investment, and with that the attractiveness of the upstream investment climate. Associated with these economic elements are different sources of uncertainty which impact the viability of the investments. These uncertainties relate to market uncertainties (price and volume risks for selling the natural gas), technical uncertainties such as the *possibility of success* (POS) of an exploration drilling, but also infrastructural access and tariff uncertainty. Regulatory uncertainty is a third important dimension, as changes in tax-regimes can have an important impact on the viability of the investment. Besides the viability of the investment – in economic terms and associated uncertainties – also investment hold-ups determine the investment. These hold-ups can originate from different sources, such as permitting-issues due to public engagement, the required capital which might exceed the firms economic capabilities, contractual problems leading to postponement or hold-ups, or excessive market uncertainties. The sum of the economic, uncertainty and hold-up criteria determine the investment, and with that the attractiveness of the upstream climate (**relation A**).

These investment characteristics are interrelated to the context (**relation D**, see above) but also to the meso level (**relation H**). Contractual arrangements can mitigate uncertainties and hold-ups, related to both granting a license and selling the natural gas. Also, the size and type of the investment determines the most adequate contractual arrangement to govern the *transaction.* **Relation F** indicates the relation between the investment characteristics and the mico level: the firm characteristics. Different firms have different criteria for investments, and different possibilities to mitigate uncertainties or hold-ups. This is related to the characteristics of the firm, as a large firm (e.g. Shell) can more properly mitigate the uncertainty of a dry hole drilling within a large exploration portfolio, than a small firm which only has the financial capability for one or two annual projects. Also, the number of investments a firm is engaged with determines the behavior of the firm.

5.4.3 MESO LEVEL: CONTRACTUAL ELEMENTS AND RELATIONS

The meso level of the developed framework concern the contractual characteristics of firms. These contracts relate to the establishment of the JOA, contracts to transport and process the natural gas, contracts with suppliers and most importantly, the sales contract. These contracts determine the attractiveness of the upstream investment climate, as they determine the associated costs of establishing and safeguarding the contracts or *transactions* (**relation B**). In addition to that, the contracts determine the level to which uncertainties and hold-ups can be mitigated (relation H, see above). The type of contracts depend on the type of investment (relation H, see above), but also on the formal institutional context in which these contracts are established (**relation E**). Also, the behavior of the firm is constraint and enabled by the established contacts (**relation G**). The other way around, firm characteristics determine the possible or desired contract as some

firms have more possibilities to establish an own commercial department, or engage as single operator in a license, than other firms.

The gas roundabout policy contributes to these contractual elements by means of the small-fields policy as this gives firms the possibility to sell their gas to GasTerra, which is obliged to take this gas against market-conform conditions (see 2.2.1) (**contribution gas roundabout 2**)

5.4.4 MICRO LEVEL: FIRM ELEMENTS AND RELATIONS

The micro level concerns elements of the firms such as the behavior, strategy, resources and capabilities. These elements are not only interrelated with the meso and macro level (**relations F and G**), but also determine the attractiveness of the upstream investment climate as such (**relation C**). As different firms have different resources (capital, knowledge, sales department etc.) and capabilities (tough gas drilling, shale gas fracking) the attractiveness of the upstream investment climate will always be *relatively* to their firm specific elements. For example, the same prospect can be attractive for firm A, but not for firm B because firm B has other investment requirements ($NPV>X_1$ vs $NPV>X_2$), more possibilities for investments because firm B operates more internationally, or a higher overhead costs which required larger projects.

The gas roundabout policy aims to contribute to the behavior of firms by means of the Fallow Acreage Covenant (see 2.3.3) and to increase knowledge resources by means of the innovation contracts (see 2.3.4) (**contribution gas roundabout 3**)

5.4.5 CONCLUSION: A METHODOLOGICAL INTERACTIONISTIC FRAMEWORK FOR ANALYSIS

The framework identified the elements and relations among these elements which are relevant to answer our research question. Insight is provided which elements determine the attractiveness of the upstream investment climate, and how the gas roundabout policy is related to those elements. This framework can therefore be used to select and compare theories in the next paragraph.

As indicated by the framework, there are three levels which determine the attractiveness of the upstream investment climate. These levels are interrelated, as extensively described above. The most suitable methodology of science would therefore be methodological interactionism. This because the structures (contract structures on the meso level and market structures on the macro level) depend on the behavior of firms on the one hand, and the behavior of firms (on the micro level) depends on these structures on the other hand. By making precise assumption about the contribution of the gas roundabout policy to the elements on all three levels, the investment behavior of firms can be explained. Explaining the investment behavior of the firms merely from out the methodological holistic approach, or from the methodological individualistic approach (e.g. WoodMackenzie) would result in a less rich insight. Therefore, this framework will be called the *methodological interactionistic framework.* The next paragraph will decide which of these elements and relations among these elements are particularly important to answer the research question, and will develop a subsequent theoretical body.

5.5 DEVELOPING A THEORY FOR ANALYSIS

The "methodological interactionistic framework" has identified the elements and relations among elements which determine the contribution of the gas roundabout policy (the contributing factors from 2.4) to the attractiveness of the upstream investment climate. This section will develop a theoretical body which can be used to make more precise assumptions about this contribution, and explain investment behavior of firms.

Section 5.5.1 will describe three relevant theories, and place other theories – which are less relevant – in perspective. The theories are relevant because they address the relevant issues of the framework, and because their assumptions correspond with the assumptions in the research domain (the real world). Section 5.5.2 will address the need for a combination of the theories; according to the theoretical pluralism criteria (see 5.3). Paragraph 5.6 will explain how this new pluralistic theory of the firm can be applied in chapter 6, and will reflect on the theory.

5.5.1 IDENTIFYING AND SELECTING RELEVANT THEORIES FOR ANALYSIS

As the figure below indicates, there are three theories which take into account a particular part of the elements and relations which are relevant to determine the contribution of the gas roundabout policy to upstream investments: (i) Porter's Five Forces Theory (green), (ii) Transaction Cost Economics (TCE) (blue), and (iii) the Resource Based View (RBV) (orange). Together, these theories address most of the important element and relations of the "methodological interactionistic framework", by making precise assumptions about these elements to explain investment behavior of firms.

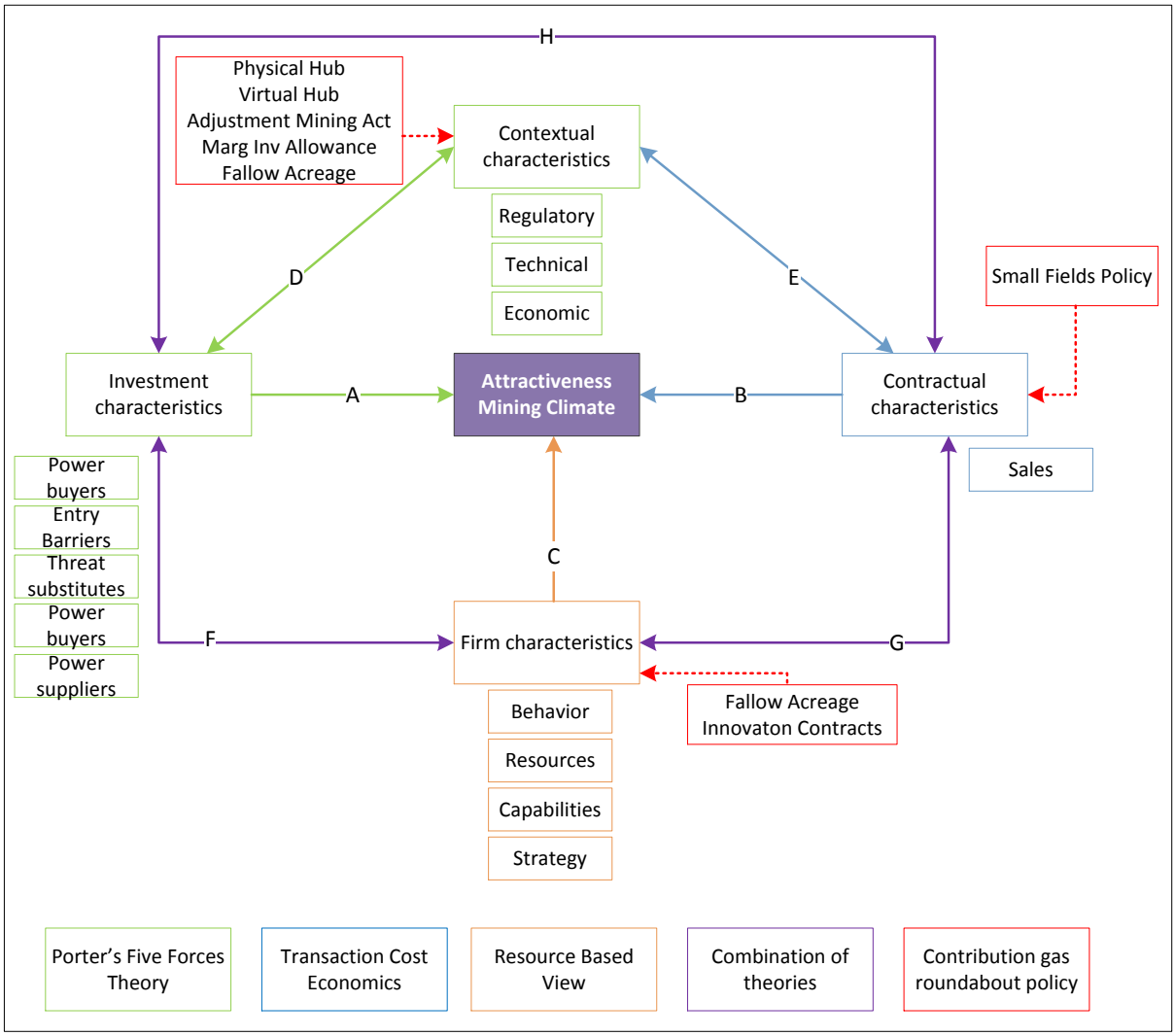


FIGURE 14: SEGEMENTATION OF THE DEEVLOPED FRAMEWORK IN THREE THEORIES

The sections below will describe the theories, and how they are relevant for this research (5.5.1.1 – 5.5.1.3). Also it will be identified that the assumptions of these theories correspond with the research domain. As there are also other theories which address parts of the framework, alternative theories – perceived less relevant – will be placed in perspective (5.5.1.4). Finally, the three theories will be reflection upon as there are also relations (purple) which are not addressed by the single theories. This might urge the need to combine the theories, in order to make precise assumptions about these relations. (5.5.1.5)

5.5.1.1 PORTER'S FIVE FORCES THEORY: BASIC CONCEPTS

Porter (1979) elaborates on five forces which determine how industry and market conditions determine a firm's investment behavior. These forces are: market rivalry, threat of substitutes and threat of potential entrants, bargaining power of consumers and bargaining power of suppliers (Porter, 1979). In his 2008 article, Porter examines the applicability of the framework, which has become a mainstream analysis framework in business practices. The framework draws upon *industrial organization economics* and can be used to determine the attractiveness of a market or industry to invest. Porter's five forces framework is a theory of firm's behavior, embedded in strategic management literature. In brief, the theory comes down to an extension of an industry's competition-level analysis beyond analyzing the established rivals, like e.g. a SWOT-analysis. Porter (1979) argues that strategic response to competition will result in long-term profits, and that the competitiveness of an industry can be characterized by five forces (Porter, 2008:1). The framework can be used by individual firms to develop strategies, or on a general level to examine the competitiveness of the industry compared to other industries. Based on the framework, a company can – strategically – determine to position itself in an industry where the forces are weakest, exploit changes in the forces or to reshape forces in the favor of the company (Porter, 2008:1). The concept *strategy* is understood as a firms' selection of a certain position in the market chosen to achieve a competitive advantage. Porter (1996) argues that for companies to survive, they must be both flexible and able to respond to structural changes within their industry. Porter tries to understand why different firms within the same industry choose to adopt varying strategies.

The five forces can be defined in general. Firstly, rivalry among existing competitors – which is the internal force that determines the level of competition in the industry itself and the propensity to earn profits – takes many familiar forms. Basically, industry intensity and the basis of competition are the two determining factors. The intensity comprise i.a. of the number of firms, the phase of the industry (expanding or mature), capacity utilization and exit- and entry barriers (Porter, 2008:9). The base of competition i.a. refers to price competition, capital intensity and economies of scale (Porter, 2008:9). The second force is the threat of substitutes, defined by Porter as the same or similar function compared to the industries' product, performed by a different mean. Porter interprets substitutes widely: "They may appear to be very different from the industries product." (Porter, 2008:8). Variables determining the threat are related to price-performance trade-offs and buyer's switching costs. Thirdly, the threat of entry impacts the overall competitiveness of an industry. Entry barriers determine the threat, and are perceived as advantages that incumbents have relative to new entrants. This advantage can be derived from supply- or demand side economies of scale, customer switching costs, capital requirements, incumbency advantages, unequal access to distribution channels or restrictive government policy (Porter, 2008:5). The fourth competition force is the power or bargaining position of suppliers, who can capture more of the value for themselves. This threat is determined by the market concentration of suppliers, supplier's dependency on the industry, switching costs of supply, substitute availability or the risk of forward integration. The last force is the power of buyers, who can i.a. force down prices. Porter: "Buyers are powerful if they have negotiating leverage relative to industry participants, especially if they are price-sensitive." (Porter, 2008:7). This power is determined by the number of buyers, standardization of the product, switching costs of buyers and the risk of backward integration (Porter, 2008:7).

Porter (2008) describes that governmental policy is an important factor which shapes the five forces. In his National Diamond Model, Porter applies his Five Forces framework, and explicitly mentions the involvement of governments (Porter, 1990:5). He states that strategic choices should not only be a function of industry structure and a firms resources, it should also be a function of the constraints of the institutional framework (Porter, 1990). The role of the government in the National Diamond Model is "acting as a catalyst and challenger. It is to encourage – or even push – companies to raise their aspirations and move to higher levels of competitive performance." (Porter, 1990:6) Porter suggests governments to encourage companies to raise their performance, stimulate early demand for advanced products, and focus on specialized *factor creation*.

RELEVANCE OF PORTER'S THEORY

Porter's theory is relevant because it addresses the macro-level issues of the framework. The theory can make precise assumptions about the *contextual elements* and relate these to the attractiveness of the upstream industry (relation D and A of the framework). These assumptions are made according to the five forces. These forces do not only examine the economical elements – such as drivers which determine the NPV – but can also examine uncertainties and other relevant elements which determine the investment behavior of firms, as is shown in figure 15 below. Moreover, the theory can examine the contribution of the gas roundabout policy to the competitive forces, as is also presented in figure 15. Therefore, the theory is relevant based on the *issues* it addresses.

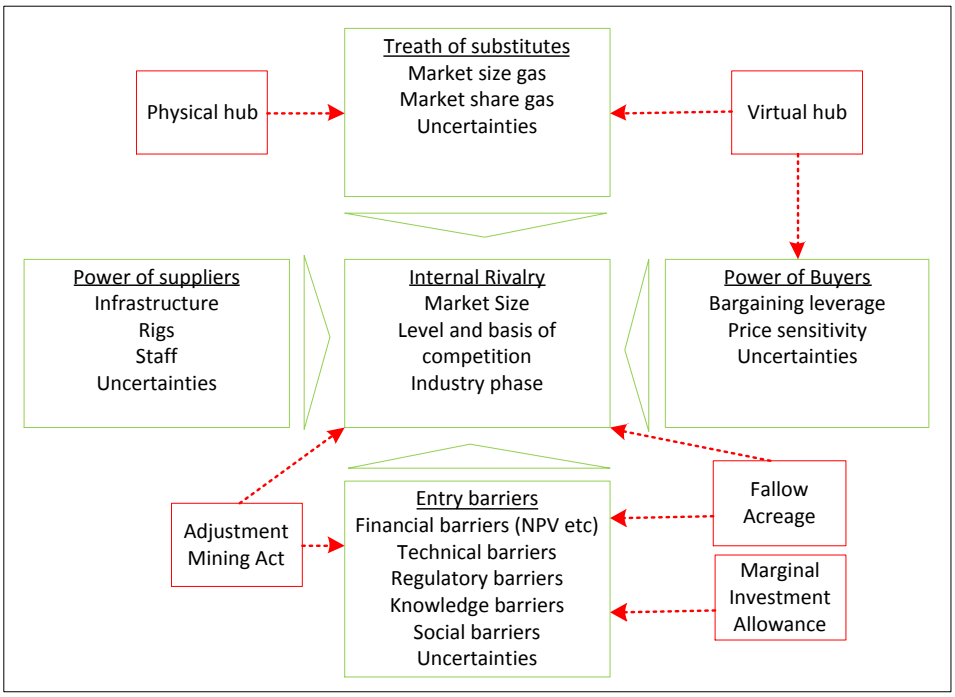


FIGURE 15: RELEVANCE OF PORTER'S THEORY FOR RESEARCH DOMAIN AND -QUESTION

ASSUMPTIONS OF PORTER'S THEORY

Apart from the issues a theory addresses, the relevance of Porter's theory also depends on the assumptions made by the theory compared to the assumptions in the research domain. Porter (2008, 2009) states that the theory is applicable under the following conditions of the research domain:

- Methodological holism;
- Firm's investment behavior is the function of the institutional framework;
- Firms' investment behavior is the function of industry and market structure;

As described in 5.4.5, the research domain has the conditions of both methodological individualism and methodological holism. Porter's theory would therefore be relevant, but not capable to explain and predict all firm's behavior, as it overlooks the methodological individualistic character of upstream investments. This limitation of the theory asks for complementary theories which address the methodological individualistic aspects of the research domain. The other assumptions are present in the research domain, as described by the framework (see5.4.1-5.4.4).

For this research domain, it can be concluded that Porter's theory is relevant as the assumptions of the theory correspond with the research domain of upstream investments. Moreover, Porter does not make assumptions about the behavior of actors with regard to rationality (Nickerson et al, 2001; Reuster, 2010:121).

5.5.1.2 TRANSACTION COST ECONOMICS THEORY: BASIC CONCEPTS

New Institutional Economics (NIE) - comprising Transaction Costs Economics (TCE), Agency Theory, Property Rights Theory and Path Dependence (Williamson, 1998:24) – is an alternative to Neoclassical economics (NCE). Before TCE will be explained more thoroughly, some fundamental theory concerning NIE will be addressed in order to place TCE in the right economic perspective.

NEW INSTITUTIONAL ECONOMICS

Institutions are elementary in New Institutional Economics (NIE), in which one differentiates between transaction costs, principal-agent problems, property rights and historical institutionalism or path dependence (Williamson, 1998). The common ground is based on the core assumption that institutions matter and subscribe to certain concepts such as bounded rationality and opportunism (Williamson, 1998). Williamson perceives NIE as an economical concept that moves beyond the neoclassical theory of the firm as a production function into a theory of the firm as a governance structure, from a merely technological construction to an organizational construction (Williamson, 1998:23). The New Institutional Economics comes in two parts. Part one deals with the institutional environment – the rules of the game – and traces its origins to Ronald Coase's 1960 paper on 'The Problem of Social Cost.' Part two deals with the institutions of governance – the play of the game – and originates with Coase's 1937 paper on 'The Nature of the Firm' (Williamson, 1998:24).

Williamson presents the economics of institutions in his four-layer model framework, which demonstrates the socio-political embeddedness of regulation (Williamson, 1998: 27). This framework helps to explain differences in economic governance from an evolutionary perspective (Groenewegen and Künneke, 2005; Correljé and De Vries, 2006). The model contributes to the understanding why economic institutions have emerged in the way that they did and not otherwise (Williamson, 1998: 25). The figure 16 below presents the four-layer model applied for upstream investments.

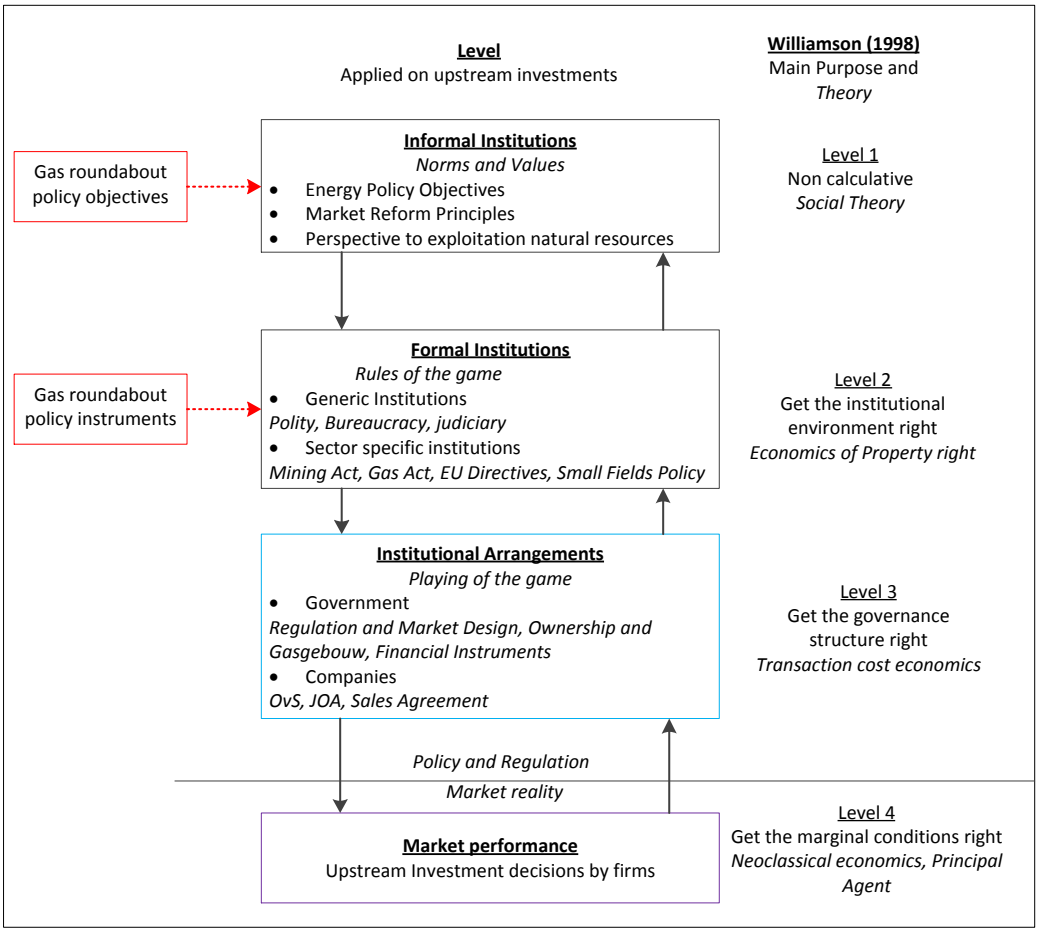


FIGURE 16: WILLIAMSONS FOUR LAYER FRAMEWORK OF INSTITUTIONAL ANALYSIS. (SOURCE: WILLIAMSON, 1998:26)

On the first layer, the informal institutions are stated. Informal institutions relate to the norms, customs, mores and traditions (Williamson, 1998: 27). Energy policy objectives and the perspective on exploitation of the state's natural resources are informal institutions. The gas roundabout policy contributes to these informal institutions by aiming for a re-position and other perspective to the natural gas system. On the second layer, Williamson states that the formal institutions like laws regarding property rights – their definition and enforcement – are prominently features (Williamson, 1998:27). This layer consists of laws and regulations. The policy instruments of the gas roundabout policy contribute to these formal institutions. The third layer comprises the process of aligning the governance structures with transactions (Williamson, 1998:29). This will be extensively described below, but the most important transaction in this research is the sales agreement between the (upstream) producer and (midstream) buyer. The fourth layer moves from discrete structural to marginal analysis. This is the level with which neo-classical economics and agency theory has been concerned (Williamson, 1998:29). Williamson's four-layer model enables the possibility to analyze institutions.

TRANSACTION COSTS ECONOMICS

Transaction costs economics (TCE) operates at the third level, dealing with the *play of the game*. Williamson describes: "TCE emphasizes on comparative economic organization (Coase, 1937), private ordering, adaptation as the central problem of economic organization (Barnard, 1938; Hayek, 1945), behavioral attributes of human actors (Simon, 1985), and the distinction between the institutional environment (formal institutions) and the institutions of governance (private contracts) (Davis and North, 1971)" (Williamson, 1998:29).

TCE subscribes to Simon's (1985) attributes of the human beings' nature: "The two key attributes to which Simon refers are the cognitive ability and the self-interestedness of human actors. Bounded rationality – behavior that is *intended* rational but only *limitedly* so – is the cognitive condition to which Simon refers. 'Frailties of motive' describes the condition of self-interestedness (Simon, 1985:303 adapted from Williamson, 1998:30). TCE subscribes to bounded rationality and states that this results in the fact that 'all complex contracts are unavoidably incomplete' as most important aspect for economic organizations (Williamson, 1998:31). Furthermore, TCE does not define 'self-interestedness' as 'frailty of motive' but as opportunism, whereupon additional contractual complications are posed. Not only does an incomplete contract contain gaps, errors, and omissions (by reason of bounded rationality), but mere promise, unsupported by credible commitments, is not self-enforcing by reason of opportunism (Williamson, 1998: 31). This research will emphasize on the sales agreement of produced natural gas as these *complex contracts.*

Attenuating the above mentioned *ex post* hazard of opportunism through the *ex ante* choice of governance is central to the TCE exercise. Transaction cost economics invokes the discriminating alignment hypothesis, according to which transactions, which differ in their attributes, are aligned with governance structures, which differ in their cost and competence, so as to effect a (mainly) transaction cost economizing result (Williamson, 1998:37). Williamson: "Upon describing firms and markets as *alternative* modes of governance, new answers to old questions can be attempted. Rather than view the efficient boundaries of the firm in terms of technology (economies of scale and scope), the efficient boundaries can be derived by aligning different transactions with governance structures (firm or market) in a discriminating way (Williamson, 1998:32). So, if all complex contracts are incomplete due to bounded rationality, resulting in hazards by reason of opportunism, what are the attributes of transactions to which contractual hazards accrue and how can they be mitigated?

TRANSACTION ATTRIBUTES: FREQUENCY, UNCERTAINTY, ASSET SPECIFICITY

According to Commons (1932: 3): "The ultimate unit of activity must contain in itself the three principles of conflict, mutuality, and order; this is the transaction." Williamson explains these dimensions as "Governance is the means by which *order,* is accomplished in a relation in which potential *conflict* threatens to undo or upset opportunities to realize *mutual* gains." (Williamson, 1998:37) Moreover, the attributes of the transaction, resulting from these three dimensions, are the frequency of the transaction, the uncertainty to which these transactions are subjected, and the condition of asset specificity determine the attributes of the transaction (Williamson 1998:36). Frequency is the occurrence of the transaction. The concept of asset specificity is elaborate upon by Williamson (1985, 1998) and Joskow (2003). Asset specificity takes a variety of forms,

physical assets, human assets, site specificity, dedicated assets, brand name capital, and temporal specificity (Williamson, 1998:36) or contract-specific (Neumann and Hirschausen, 2006:137). Whatever the particulars, the basic regularity that is associated with transactions that are supported by investments in specific assets is that these assets cannot be redeployed to alternative uses and users without loss of productive value (Williamson, 2010:680; Williamson 1971, 1975, 1985; Klein et al 1978). Asset specificity for Dutch upstream investments mainly comes down to site specificity, physical asset specificity and dedicated asset specificity (Correljé and Groenewegen, 2006:8).

Based on Klein et al. (1978), uncertainty refers to behavioral and environmental uncertainty. Behavioral uncertainty is deduced from the bounded rationality assumption that New Institutional Economics (NIE) is based upon. Humans are limited in their capacities to process information and may further behave in an opportunistic way. Behavioral uncertainty refers to *ex post* opportunistic behavior by one contracting partner (Haase, 2009:88). The contracting partner could be the government or regulator, resulting in regulatory opportunism (Spanjer, 2009), or another private actor, resulting in contractual hazards. Both modes of behavioral uncertainty, caused by bounded rationality and the subsequent opportunism, might delay or withhold investments (Haase, 2009: 88; Klein et al., 1978). Environmental uncertainty does not refer to judging human behavior on whether actions are sustainable in an environmental/ecological sense, but refers to uncertainty as to the way the human environment is developing. Environmental uncertainty stems mainly from unanticipated changes in factors or conditions that affect transactions. (Haase, 2009:88) Therefore, uncertainty relates to the other external characteristics to the upstream investment context, as for example regulation or structural changes in the infrastructure. The gas roundabout policy can be seen as a change in the environmental uncertainty as it contributes to economical and regulatory uncertainty (positively or negatively).

GOVERNANCE ATTRIBUTES: INTERNAL AND EXTERNAL SAFEGUARD MECHANISMS

Depending on the potential *ex post* hazards, caused by the transaction attributes, a particular mode of governance is best suitable to mitigate these hazards. The modes of governance are: the market (spot contracts on the exchange), hybrid modes or neoclassical contracting (bi-lateral long-term contracting), and public bureau modes of governance (vertical integration, establish an own commercial department to 'buy' the produced natural gas) (Williamson, 1998:37). Joskow (2003) has identified theoretical *optimal* modes of governance, which theoretically result in the lowest transaction costs for both parties. These modes of government depend on the transaction attributes:

TABLE 6: EFFICIENT MODES OF GOVERNANCE. SOURCE: JOSKOW (2003)

		Asset specificity		
		Low for both parties	High for both parties	High for only one party
Uncertainty	High	Long-term contract (hybrid) or vertical integration	Vertical integration	Vertical integration
	Low	Spot contracts	Long-term contract (hybrid)	Vertical integration

Williamson elaborates on the modes of governance: "if adaptation (of both autonomous and cooperative kinds) is the central purpose of economic organization, then the comparative efficacy of alternative modes of governance in both adaptive respects needs to be described. Further, since governance works through instruments, of which incentive intensity and administrative controls are basic, then governance structure differences of these two kinds need to be developed." (Williamson, 1998:37)

Governance structures comprise internal and external instruments to eliminate the *ex post* hazards. Internal governance instruments are arrangements that private parties themselves contract upon: monitoring, bonding, damage compensation and adaption rules. External instruments are interventions by an outside body (Williamson, 1979:251). External instruments are aimed at keeping parties in check, internal provide an incentive to invest in private control mechanisms. Intrusion is the level in which parties allow authority to other

bodies than themselves to describe, prescribe and sanction the way in which they transact with each other. Intrusion is the variable that characterizes market governance arrangements (Couwenberg and Woerdman, 2006:4).

Williamson (1997) extends these two kinds of governance and explains the four degrees of freedom and differences between the governance structures. Firstly, incentive intensity, referring to the high-powered incentives of markets give way to low powered incentives in firms. Secondly, administrative controls: firms are supported by a more extensive array of administrative rules and procedures. Third, adaptation: markets enjoy the advantage in effecting autonomous adaptation in response to changes in relative prices, but the advantage accrues to firms as more cooperative adaptations are needed. Fourth, contract law: the contract law of markets is legalistic and relies on court ordering whereas the firm supplants court ordering by private ordering and settles disputes by fiat (in effect, the firm is its own court of ultimate appeal) (Williamson, 1998:37).

FROM TRANSACTION GOVERNANCE TO INVESTMENTS AND PERFORMANCE: COST OF SAFEGUARDING

The interplay of contract incompleteness, asset specificity and opportunism creates *ex post* contractual hazard which requires costly safeguards: cost of handling a particular transaction consist of the direct contracting costs (writing, monitoring, verifying, enforcing) and the cost of *ex post* contractual hazards. How does this relate to economic performance and investments?

Yvrande-Billon and Saussier state that: "The more misaligned an organizational or contractual choice, the poorer the performance." (Yvrande-Billon and Saussier, 2005:78) Economic performance can be optimized by increasing productive, allocative and transaction cost efficiency. Where production costs are related to the execution of a firm's contractual decision, and comprise material, labor and financial costs, transaction costs relate to arranging the contracts *ex ante* and monitoring and enforcing the contract *ex post* (Dixit, 1996:38). *Ex ante* transaction costs arise in the contract set-up phase, including drafting and negotiating the contract. *Ex post* transaction costs are those costs arising after the contract has been agreed. In other words, the costs related to the setting up and running costs of the chosen governance structure, and also include the costs of safeguarding the contracts execution in the form of monitoring contract specifications and settling disputes in the event of conflict. Klein (1999) argues that investment hold-up problem is the best-known example of an *ex post* contractual hazard (Spanjer, 2009). Therefore, the transaction cost economizing result can be seen as the derivative of the alignment hypothesis, affecting investment hold-ups.

The figure 17 below graphically presents the alignment hypothesis, and how it is related to the framework.

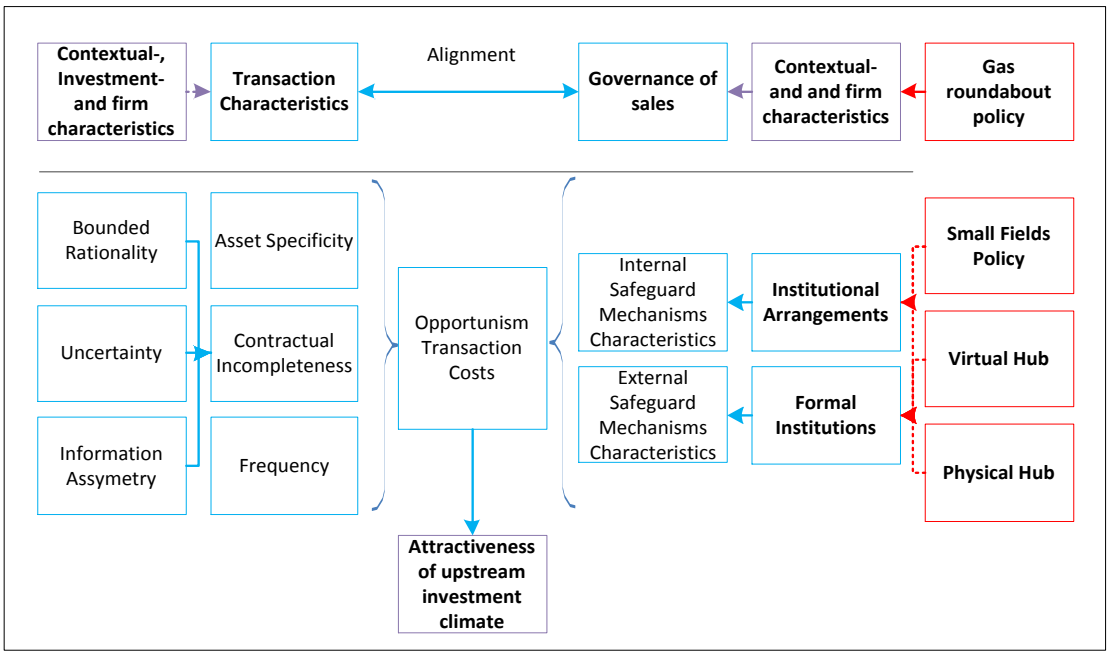


FIGURE 17 TRANSACTION COSTS ECONOMICS ANALYSIS FRAMEWORK. SOURCE: OWN COMPOSITION

RELEVANCE OF THE TCE THEORY

TCE can make precise assumptions about the contribution of the gas roundabout policy to the meso-level, concerning contractual elements. By working out the above mentioned elements, it can be determined to what extent the gas roundabout policy contributes to the attractiveness of the upstream investment climate. Because it is only the sales agreement which is affected by the gas roundabout policy, the other contractual elements of the framework - establishing the JOA and the OvS, and establishing an agreement for transport and processing of natural gas – will not be addressed by TCE theory. To answer the research question, it is sufficient to only address the sales agreements as this is the contractual element which is expected to be mostly affected by the gas roundabout policy. The other contractual elements will not be overlooked by this research, as Porter's theory can also examine these to some extent. The TCE is therefore relevant as it can examine the most important contractual element of the framework, related to the gas roundabout policy.

ASSUMPTIONS OF THE TCE THEORY

Based on Williamson (1996), the TCE theory is applicable when the research domain is characterized by (Williamson, 1996; Spanjer, 2009; Groenewegen and Vromen, 2006):

- Methodological individualism;
- Asset specificity;
- Opportunism;
- Contractual incompleteness;

As elaborated in 5.4.5, the research domain is characterized by both methodological individualism and methodological holism. Therefore, the TCE theory is relevant but it is only capable to address part of the research domain. It is necessary to complement the theory with other theories, addressing complementary issues and the research domain from a holistic methodology.

Among others, Correljé and Groenewegen (2006), Reuster (2010), Spanjer (2008), Haase (2008) and Helm (2005) have extensively described the presence of the other three assumptions, or the relevance of TCE for analyzing investments in the natural gas system. In brief, asset specificity is an elementary characteristic of both upstream investments and operations. It is identified that there are three types of specificities present for upstream investments (site-, dedicated-, and physical asset specificity). Also opportunism is present. For this study, reference will be made to the two types of opportunistic behavior as identified by Reuster (2010). Firstly, deviations from joint-surplus maximizing within the terms of an existing agreement. This type of opportunism is especially relevant for analyzing the JOA and the OvS. This will not be further addressed. Secondly, enforcement of renegotiations and modifications of contractual terms in the case unexpected changes in market conditions evolve (Reuster, 2010:12). This form of opportunism is especially relevant for analyzing sales agreements and will be addressed when applying the theory. Contractual incompleteness is the product of bounded rationality and uncertainty. As identified by other scholars (among others Hubbard and Weiner, 1986; Spanjer, 2008; Haase, 2009), the assumption of bounded rationality seems reasonable for the natural gas value chain. Also, there are many uncertainties associated with upstream investments and the sales of natural gas. These uncertainties can be of different nature. Examples are regulatory uncertainty, infrastructural uncertainty, technical uncertainty and market uncertainties, as described by the framework. For this research domain, it can therefore be concluded that TCE is relevant as the assumptions of the theory correspond with the research domain.

5.5.1.3 RESOURCE BASED VIEW: BASIC CONCEPTS

Barney's (1991) resource-based view suggests that it is firm specific differences that drive strategic investments and performance (Peng, 2008: 1, Barney, 1991). The resource-based view (RBV) was introduced by Penrose (1968) and further elaborated by several scholars, of which Barney was the most prominent (Barney, 1991). Basically, the RBV argues that sustained competitive advantage derives from the resources and capabilities a firm controls that are valuable, rare, imperfectly imitable, and not substitutable. Resources and capabilities are segmented in physical capital resources, human capital resources and organizational capital resources. (Barney, 1991:101)

RELEVANCE OF THE RBV THEORY

The RBV addresses the investment behavior of firms (issue), by making precise assumptions about the elements firm specific resources and capabilities of the framework. By applying the RBV theory, it can be explained why different firms differently judge the attractiveness of the upstream investment climate, according to their resources and capabilities.

ASSUMPTIONS OF THE RBV THEORY

Barney (2001a) elaborates that the RBV initially was positioned relative to the structure-conduct-performance (SCP) paradigm (Barney, 1991) The SCP paradigm, assuming that resources and capabilities are elastic in supply, was challenged by the RBV which points at the path-dependent element which result in limited elasticity in some industries (Barney, 2001:645). The core presuppositions of the RBV are (Barney, 2001a:649):

- Methodological individualism;
- Resources and capabilities can be heterogeneously distributed across competing firms;
- Differences in resources and capabilities can be long lasting, and that they can help explain why some firms consistently outperform other firms;

The research domain has the conditions of both methodological individualism and methodological holism (4.4.5). RBV theory would therefore be relevant, but not capable to explain and predict all firm's behavior, as it overlooks the methodological holistic character of upstream investments.

Resources and capabilities are indeed heterogeneously distributed across competing firms in the research domain. Examples of such resources are capital resources, infrastructural ownership resources, knowledge resources and capabilities to perform certain activities (e.g. fracking technologies). Also, these differences can be long-lasting. For the research domain of this study, it can therefore be concluded that the RBV is relevant on the basis of its presuppositions (see also De Haas, 2007). When the domain of research would be related to for example *grocery sellers on municipal markets,* these assumptions would not hold.

5.5.1.4 LESS RELEVANT THEORIES

The three theories above are considered relevant because their presumptions correspond with the research domain, and because they address the relevant issues of the framework. As there are numerous other theories, which also examine parts of the framework, this section will briefly describe why some other theories are less relevant for this study.

STRUCTURE-CONDUCT-PERFORMANCE

The macro-level elements of the framework are also addressed by the Structure-Conduct-Performance (SCP) theory of the firm. The theory assumes that the market structure – the number and relative size of the firms in an industry – determines the conduct of the firm, like pricing or output behavior. Firm conduct yields an industry's overall performance in terms of static efficiency, which is "the optimal combination of given inputs, subject to the constraints imposed by a fixed production function." (Klein, 1984: 46) However, this theory is less relevant as its assumptions (see Arnsperger et al. 2006) corresponds less with the research domain, compared to Porter's theory, as three examples will point out. Firstly, the SCP paradigm emphasizes on a static equilibrium. SCP assumes that human interactions always tend towards an equilibrium, which in economic terms refers to a situation where supply and demand is in balance (Spanjer, 2008:61). The alternative to static equilibrium, or static efficiency, is dynamic efficiency (Ghemawat and Ricart, 1993; Klein, 1984). Ghemawat and Ricart (1993) describe static efficiency in terms of the refinement of existing products, processes or capabilities, and state that the development of new ones is the concern of dynamic efficiency. Because this study is concerned with attracting new investments in the Dutch upstream industry, dynamic efficiency forms an important argument to elaborate more on the difference between the two equilibriums. Secondly, SCP assumes perfect information, resource homogeneity, clear preference structures, and perceives the firm merely as a production function. Due to firm-specific elements, the resources are however heterogeneously distribution in the resource domain. Also, there is bounded rationality, which results in *satisfying* behavior, rather than *maximizing.* And, as the framework points at the importance of institutions, the firm is more than a

production function on the research domain. Thirdly, SCP only allows for government involvement in case of market failures or public goods. As Mulder and Zwart (2006) point out, the involvement of the Dutch government is aimed at more elements than restoring *perfect competition* or safeguarding public goods, illustrated by the role of state-participants EBN and Gasunie. The SCP paradigm is therefore less relevant as its presumptions deviate from the research domain.

OTHER THEORIES OF THE FIRM

The Behavioral Theory of the Firm explains how decisions are taken within the firm: "Firms cannot be regarded as monolith, because different individuals and groups within have their own aspirations and conflicting interest, and that firm behavior is the weighted outcome of these conflicts." (Cyert and March, 1963) This theory explains firms' behavior, but the 'internal decision-making processes of firms' are not considered to be a *particularly* relevant element to answer this research question. Secondly, there is the Theory of the Entrepreneurial Firm (Langlois, 2005). This theory explains and predicts the *nature and boundaries* of a firm. As this study is interested in another *issue,* namely the behavior of firms instead of the boundaries of firms, this theory is less relevant for this study.

CORPORATE FINANCE: THE POSITION OF NPV AND EMV

As addressed earlier, industry-reports such as WoodMackenzie (2000) imply that firms' investment decisions are merely based on criteria from the domain of corporate finance, such as net present value (NPV) and expected monetary value (EMV). Naturally, these elements are important to consider in a research which addresses the investment-behavior of firms. However, these corporate finance theories are not placed central in this study for several reasons. Firstly, these theories perceive the firm as a production-function rather than an institution, involve many confidential data and ambiguous assumptions, and are very case-specific. WoodMackenzie (2000) suggests that investment-decision of firms merely depend on corporate finance criteria. The "methodological interactionistic framework", and the considerations of this chapter illustrated that this would be a limited approach to analyze investment-behavior of firms, as there are numerous other factors which driver firm's behavior. There is a need for a more comprehensive approach. Secondly, placing corporate finance central in this research would limit the possibility to explore for elements which drive investment-behavior, other than financial criteria. Examples are infrastructure access, public engagement, the availability of plays, etc. Linking all these elements to a NPV or EMV-calculation would involve challenging or even ambiguous assumptions. Also the role of the government and the contribution of policy is challenging to link to corporate finance assumptions. In a more delineated study, NPV and EMV can function as interesting *models* to predict investment behavior. A subsequent study can attempt to link insights from this research to such a model. This research incorporates the most important elements of these corporate finance criteria (revenues, capex, opex and uncertainty) by means of Porter's theory.

5.5.1.5 REFLECTION ON THE THREE SELECTED THEORIES: SHORTCOMINGS AND THE NEED TO COMBINE

To answer the research question of this study, all relevant elements and relations from the framework must be addressed. As there does not exist a theory which takes into account all issues, this study must *develop* a theory. The three identified and described theories above are found to be *relevant* as each of them addresses a relevant *set* of elements and relations (issues), and the assumptions of the theory correspond with the research domain. In general, all three theories address the issue of *investment behavior of firms.* As mentioned in figure 14, not *all* relevant relations are addressed by the sum of the three theories. Insight concerning these relations (F, G and H in figure 14) can only be generated by combining insight from the theories. This *synergy* provides a first argument for combining the theories.

In addition to that, analyzing the contribution of the gas roundabout policy to the attractiveness of the upstream investment climate by some of the three theories would result in an incomplete picture of the *methodological interactionistic* research domain. The need to approach the research domain from such a *interactionistic methodology* provides a second argument for a combination of theories, instead of only applying some of the theories.

Apart from these two considerations the individual theories also have other shortcomings. These will be briefly addressed below. By combining theories, shortcomings of theories can be compensated – resulting in a more rich and relevant theory for analysis to answer the research question more satisfyingly.

The main shortcoming Porter's theory is that it assumes that parties (sellers and buyers) do not interact. Another shortcoming is that it is not feasible to evaluate the attractiveness of an industry independent from the resources and capabilities of specific firms. Porter does not recognize this in his theory. As these two features – and other such as asset specificity – are not recognized by Porter, applying only Porter's theory would results in an incomplete picture of the research domain. The strong points of Porter theory are the broad scope of the theory. This is suitable for a exploratory study such as this research. Porter goes beyond explaining investment behavior merely from EMV or NPV, resulting in a more comprehensive overview.

A shortcoming of TCE is that it explains investment behavior only by putting the transaction central in the analysis. Although the transaction certainly can be an explaining phenomena to some extent, upstream investments are taken on a much more variety of criteria. TCE does not place the *investment hold-up* stemming from safeguarding the transaction (and mainly behavioral uncertainty) relative to other explaining variables such as environmental uncertainties (e.g. dry-hole uncertainty) which might be of other magnitudes, and of which *governance arrangements* have no effect. By establishing a more comprehensive set of explaining variables for a possible investment hold-up, the *relative* explaining power of TCE can be argued by comparing the transaction costs with other elements (such as dry-hole drillings and other entry-barriers).

Lastly, RBV's main shortcoming is also the limited scope of explaining investment behavior. Firms with similar resources and capabilities can come to other investment decisions when they, for example, establish different governance arrangements with other firms. The interaction between firms is therefore overlooked by the RBV.

Concluding, combining the theories would subscribe better to the *methodological interactionistic* nature of the research domain, incorporates *all* relevant elements and relations of the framework, gives synergies when insight from the three theories is combined, and it can be used to compensate shortcomings of the individual theories. Therefore, there is a strong need to combine the three theories. The next paragraph will attempt to satisfy this need. When the theories can be combined, paragraph 5.6 will again reflect on the *combined theory.*

5.5.2 COMBINING THE THEORIES: TOWARDS A *PLURALISTIC THEORY OF THE FIRM*

Where the previous paragraph identified three relevant theories, this paragraph will aim to combine these theories into one pluralistic theory, as described in 5.3. It will be determined whether the theories can be extended to each other (5.5.2.1), or if the theories use confronting presumptions (5.5.2.2). Thereafter, the pluralism of the theory will be described (5.5.2.3).

5.5.2.1 EXTENDIBILITY OF THE THEORIES

Groenewegen and Vromen (1996) distinguish between extensible and non-extensible theories. "Non-extensible theories are theories that are not only silent on other issues, but that also cannot be brought to bear on other issues. Extensible theories are theories that can be brought to bear on other issues." (Groenewegen and Vromen, 1996:374). Criteria are, among others, the apparatus of analysis (e.g. static comparative analysis for TCE), the unit of analysis (e.g. the transaction for TCE), or the applied methodology of the theory.

Both RBV and TCE share the assumptions of methodological individualism, and both theories are silent about the majority of conditions under which the alter theory is applicable. The stringent difference between the two theories is, however the *unit of analysis*. Where the *firm's resources and capabilities* is the central variable in the RBV theory which *explains* a firm's behavior, the *transaction* is the explaining variable for the TCE theory. Both theories focus on different elements of the framework to address the same issue. Also, the RBV is relevant when the behavior of the firm is explained because firms act to maximize resources and capabilities, where TCE is relevant when the behavior of the firm is explained by addressing elements aimed at minimizing transaction costs. The RBV can therefore not be extended to TCE. Conner (1991) and Mahoney (2001) discuss where the RBV stands relative to TCE. Mahoney argues that, in the line of Williamson (1975), resources and

capabilities (e.g. routines and culture) are being developed within a firm in superior ways to market contracts. This is not because of the absence of opportunism as Conner (1991) assumes, but because of a certain level of opportunism, and the subsequent governance forms as explained by TCE (Mahoney, 2001:654). Therefore, in line with Barney (2001) and Mahoney (2001), it is concluded that TCE cannot be extended to the RBV to that both theories are rather complementary because RBV is a theory of the firms rent and TCE a theory of the existence of the firm.

The RBV theories' assumption of methodological individualism is hard to *extend* to Porter's assumptions of methodological holism without drastically changing the assumptions of the RBV theory. These theories could maximally be combined. Where Porter focuses on external elements that explain and predict the behavior of firms, RBV focuses on internal firm-specific resources and capabilities that explain and predict the behavior of firms. Barney (1991) elaborates that both theories cannot be unified because the level of analysis is too different, and that both theories are complementary to each other. (Barney, 1991:100) Extending Porter's theory of the firm to TCE or RBV is, as mentioned before, problematic because Porter departs from methodological holism. Also the methodological individualistic TCE cannot be extended to the methodological holistic Porter's theory.

5.5.2.2 CONFLICT OF THE THEORIES

There are two conditions which are different between the three *relevant* theories. The first is the difference between Porter's theory and both RBV and TCE. The methodological holistic condition of the first theory and the methodological individualistic condition of the two latter. The second difference is the presupposition of the RBV that firms behave to maximize their resource and capabilities, where TCE explains or predicts the same behavior but assumes that this behavior is driven by minimizing transaction costs. This section will address whether these two categories of *differences* are *contradicting* or that these differences can be overcome within a *pluralistic theory of the firm.*

Groenewegen and Vromen (1996): "Theoretical pluralists cannot accept just any combination of theories. If theories, or their central claims, contradict each other, then their lasting co-existence is unacceptable to theoretical monists and pluralists alike. For accepting contradictions implies acceptance of "anything goes": all conceivable theories (including ones that are clearly nonsensical) are equally acceptable. Theories may conflict with each other, for example, in what is seen as the central explanatory variable for some given set of phenomena (issue)." (Groenewegen and Vromen, 1996:371)

So, because Porter's theory addresses different phenomena to explain the same issue (firm behavior) relative to TCE/RBV, the theories are not conflicting. As the next section will point out, the fact *that* Porter's theory and TCE/RBV differ in their methodology, makes them suitable candidates for a pluralistic theory of the firm because the research domain has the condition of *methodological interactionism.* With that, the research domain asks for either a theory which conditions methodological interactionism or a pluriform theory which takes into account both methodological individualism and – holism for a richer understanding of the research domain than one of the two perspectives would create. Because TCE and RBV both address other categories of elements – both relevant to answer the research question according to the framework – and therewith different phenomena relevant to the same issue, the two theories are not contradicting each other but can be rather complementary.

5.5.2.3 PLURALISM

Based on the issues and conditions of the theories, table 7 below presents the pluralism of TCE with the RBV theory and Porter's theory:

TCE is complementary with Porter's theory because they both address the same relevant issue – firm investment behavior – but depart from different conditions, which are all relevant to make explanations of the issue within the research domain (see also Reuster and Neumann, 2009; Reuster, 2010 and Nickerson, 1997). TCE is complementary with Porter's theory as both theories subscribe to different non-rival phenomena to

explain the behavior of firms. Also RBV and Porter's theory are complementary because of these arguments (see Barney, 1991; Lockett and Thompson, 2001; Mahoney, 2001; Combs and Ketchen, 1999). Combining the three theories into one pluralistic theory of the firm is legitimate because the theories are complementary, non-rival and enrich the total understanding of the issue.

TABLE 7: PLURALISTIC THEORY OF THE FIRM

Issues / Conditions	**Same**	**Different**
Same		
Different	RBV theory Porter's theory	

Concluding, the three theories can be combined into one new *pluralistic theory of the firm.* The next chapter will reflect on this new theory by describing the added value, shortcomings and applicability.

5.6 REFLECTION ON THE DEVELOPED *PLURALISTIC THEORY OF THE FIRM*

This *pluralistic theory of the firm* has several advantages compared to the individual theories. The created additional insight goes beyond the scope of the theory - meaning that the theory does not only address *more* issues, but addressing issues differently, namely with more *eye for the interrelatedness*. This is further explained below.

First of all, the pluralistic theory is capable to address the *methodological interactionistic* nature of the research domain. This creates additional insight in the contribution of the gas roundabout policy to the attractiveness of the upstream investment climate. Where most theories and studies only explain firms' behavior from one methodology, this pluralistic theory gives a more comprehensive and nuanced picture. This study can therefore complement insight from reports such as WoodMackenzie (2000), who address the attractiveness of an upstream investment climate merely from out a individualistic methodology, addressing only one the NPV and POS. Secondly, this theory can be used to explain what policy makers overlook, when they address the issue from a holistic methodology. This is enables by the comprehensive and exploratory nature of the theory. Thirdly, the relations between the three levels of the framework (H, F, G in figure 13) - which are not especially dealt with by one particular theory - can be examined by this pluralistic theory of the firm. Explanations from one level can possibly also contribute to the understanding of the issue in another level. For example, insight from the micro-level (RBV) can help to explain issues on the macro-level (Porter). Therefore, the shortcomings of the individual theories (see 5.5.1.5) are compensated by the pluralistic theory of the firm as actor-interaction, firm-specific, and investment-specific characteristics can be embraced.

As any other, the pluralistic theory of the firm also has limitations. These limitations comprise this particular study, and applicability of the theory in future research as will be elaborated upon below. For this study, the theory can contribute to explore and identify different variables, and make precise assumptions about these different variables – and the interaction with other variables. The variables (e.g. the contribution of the gas roundabout policy to the variable "permitting", and the extent to which permitting has a positive or negative contribution to the upstream investment climate) are, however, of different nature. This makes it hard to "rank" or "compare" the *relative* contribution of these different variables, especially as these variables may originate from three different theories. This will therefore also not be conducted, to avoid such ambiguity. The main contribution of the theory is the *interactionistic* and *comprehensive* or *pluriform* insight, adding to the needs of the shortcomings of the individual theories and enabling this study to answer the research question. The product of applying the *pluralistic theory of the firm* is therefore more a comprehensive overview of the relevant variables in the research domain, and how these variables interact, than a precise "pie-chart" of contributions of the policy. Still, this will enable scholars and policy makers to determine the contribution of

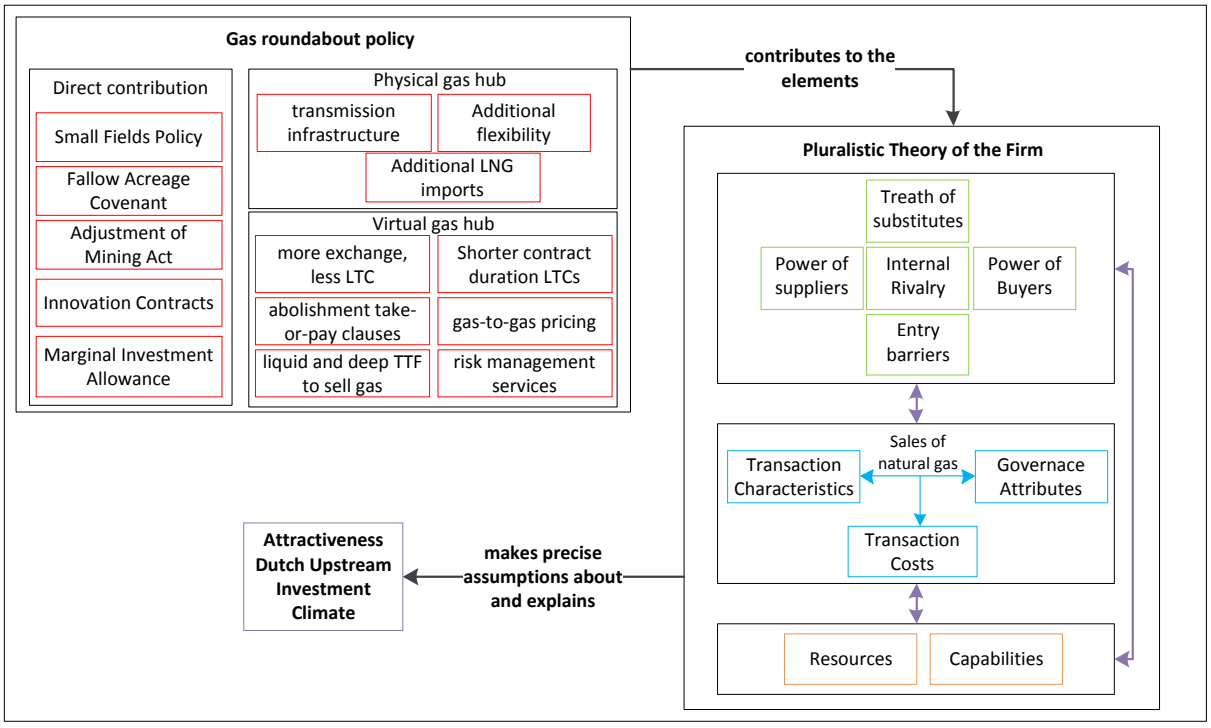
(the gas roundabout) policy to the attractiveness of the upstream investments climate, as will be conducted in chapter 6.

This particular *pluralistic theory of the firm* (as operationalized for this studies' research domain in figures 17) is applicable to research domains in which the same conditions are present as in the research domain of upstream investments, and when the central issue is concerned with the behavior of firms. When the problem statement would be different (e.g. explain firms behavior on basis of internal organization), another framework would be constructed and other elements would be relevant. Therefore, this theory is not very general, but can be applied to other research domains which has the same conditions, to address the same kind of issues. In general, this applied sequence of steps to develop a theory is very generally applicable, and can support any further theoretical research.

5.7 CONCLUSION

This chapter had the aim to answer the following research question: 'How can the contribution of the gas roundabout policy to the attractiveness of the Dutch upstream investment climate be analyzed?'

By using a systematic approach – based on Ostrom (2011) and Groenewegen and Vromen (2006) – the *pluralistic theory of the firm* was developed. This theory is relevant to analyze the contribution of the gas roundabout policy to the attractiveness of the Dutch upstream investment climate. This theory makes use of three existing theories – Porter's theory, Transaction Cost Economic theory, and the Resource Based View theory – and is capable to provide a *methodological interactionistic* perspective to the contribution of the gas roundabout policy. The figure 17 below graphically illustrates how the theory can be used in the next chapter.



FIGUUR 18 APPLICATION OVERVIEW OF THE PLURALISTIC THEORY OF THE FIRM

To determine the precise contribution of the gas roundabout policy (red boxes) to the attractiveness of the upstream investment climate (purple box), the elements of the pluralistic theory of the firm must be elaborated. First, it must be questioned: "What is the initial attractiveness of the Dutch upstream investment climate?" by determining the effects of the variables of the pluralistic theory of the firm to the attractiveness. Thereafter, it can be questioned: "What is the contribution of the gas roundabout policy to the attractiveness?" by identifying how these variables change due to the gas roundabout policy (see also figures 15 and 18).

Insight from the application of the theory will not only answer the research question, it will also provide insight in all elements which determine the attractiveness of the upstream investment climate, aligned with the *exploratory* nature of this research. When the gas roundabout policy only limitedly contributes to the attractiveness the results of the applied theory can also be used to amend the gas roundabout policy.

6. APPLYING THE PLURALISTIC THEORY OF THE FIRM

This chapter will apply the pluralistic theory of the firm, aiming to answer the following research question:

What is the contribution of the gas roundabout policy to facilitating upstream investments?

As mentioned in 5.7, this question can be answered by addressing the two questions below, for all three parts of the pluralistic theory of the firm.

- *What is the initial attractiveness of the Dutch upstream investment climate?*
- *What is the contribution of the gas roundabout policy to the attractiveness?*

As presented in the figure 19 below, the first chapter (6.1) will apply Porter's theory, the second chapter (6.2) will apply Transaction Cost Economic (TCE) theory, the third chapter (6.3) will apply the resource-based view theory (RBV), and the fourth paragraph will emphasize on the interrelation between the theories (6.4). Conclusions will follow, answering the research question (6.5).

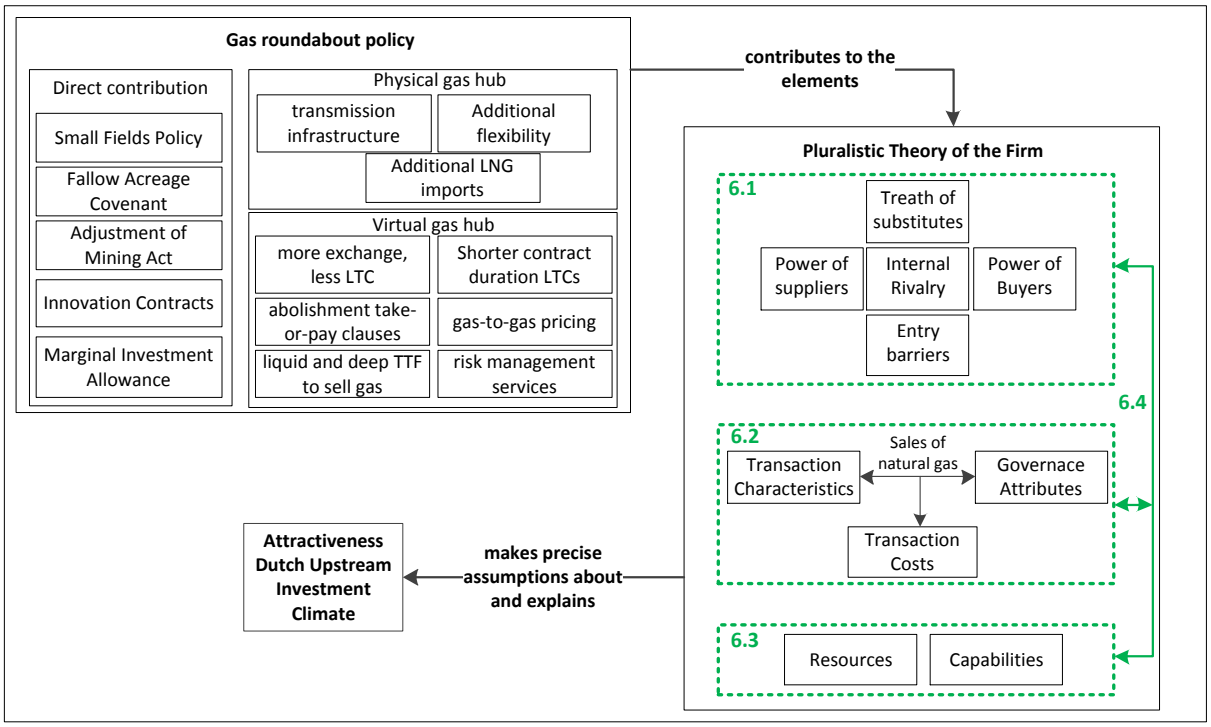


FIGURE 19: OUTLINE OF CHAPTER 6

6.1 CONTRIBUTION OF THE GAS ROUNDABOUT POLICY ACCORDING TO PORTER'S THEORY

This paragraph will address the initial attractiveness of the Dutch upstream investment climate, and determine the contribution of the gas roundabout policy to the attractiveness. As illustrated in the figure 20 below, each paragraph will examine one of Porter's forces (6.1.1-6.1.5) and a final paragraph will conclude by answering the research question from the perspective of Porter's theory (6.1.6).

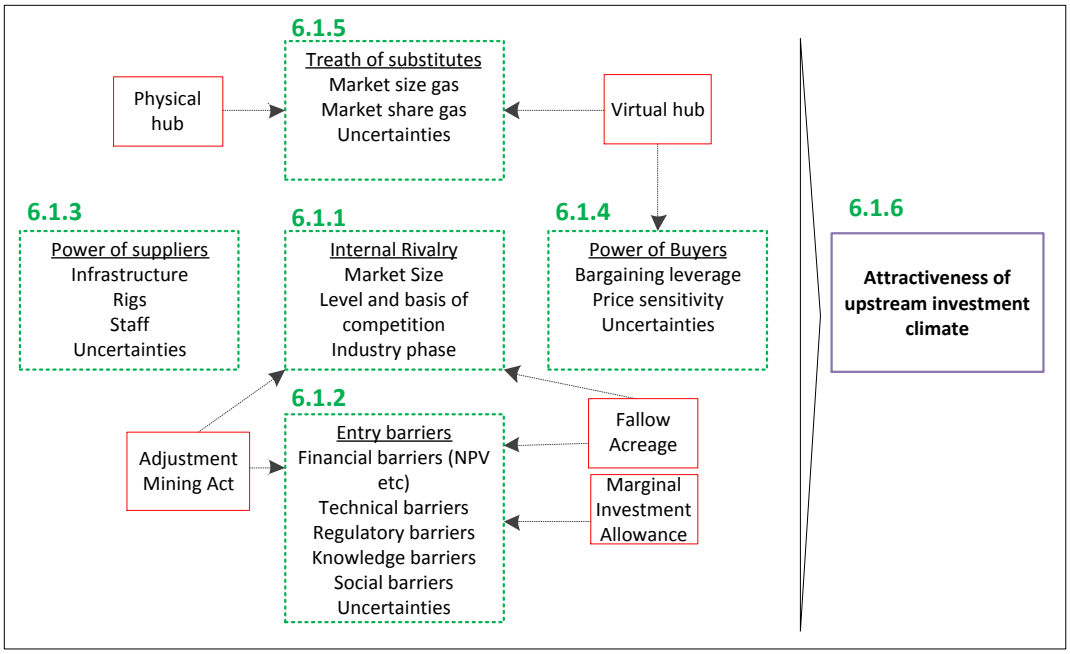


FIGURE 20: OUTLINE CHAPTER 6.1

6.1.1 INTERNAL RIVALRY AND COMPETITIVENESS

High rivalry limits the profitability of an industry. The degree to which rivalry drives down an industry's profit potential depends on the intensity with which companies compete, and the basis on which they compete (Porter, 2008).

6.1.1.1 INITIAL ATTRACTIVENESS

The three main drivers which determine the internal rivalry and competitiveness of the Dutch upstream industry are the *potential market size for investments*, the *level and basis of competition* between competing oil firms, and the *phase* of the industry.

MARKET SIZE

Because of its geographical location, the Dutch subsurface is richly endowed with natural gas, however only a small part of this natural gas is technically recoverable. Some of this technically recoverable gas is already recovered (~2.722 bcm, TNO, 2010). This gas was economically recoverable, and a large amount of natural gas can still be recovered from a technical point of view (~16.854 bcm). However, economic-, regulatory-, and social constraints limit the (currently) available viable natural gas from small-fields. This *available potential* can be segmented in plays for exploration, and plays for production.

1. Plays for new exploration

With regard to exploration activities, a total amount of 1000 on-shore and 500 off-shore prospects can be explored for, containing about 400 bcm of natural gas (EBN, 2011:11). This indicates that there are sufficient possibilities for oil companies and investors to engage in exploration activities. However, not all of these prospects are actually available for new exploration. On average between 6 and 13 wells were drilled to explore the prospects over the period 2006-2011 (EBN, 2012:21).

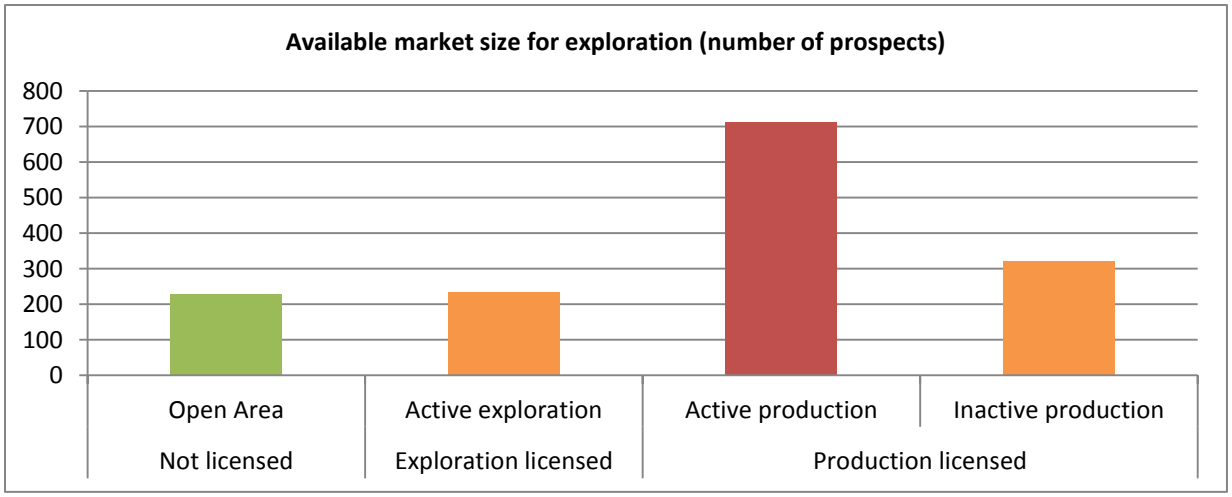


FIGURE 21: AVAILABLE MARKET SIZE FOR EXPLORATION ACTIVITIES (GREEN = DIRECTLY, ORANGE = POSSIBLY IN FUTURE DEPENDING ON CURRENT EXPLORATION ACTIVITIES AND RETURN OF LICENSE (EBN, 2011:22)

For new exploration investments, 200 prospects (containing 97 bcm, risked) can be explored for by directly applying for a license (green bar). Another 200 prospects (92 bcm) are currently being explored for, so these are (temporarily) not available for new exploration activities but might be when the current license holders return the license (mostly after 2-3 years). 700 prospects, containing 167 bcm (EBN, 2011:22) cannot be explored for because they are on a surface where natural gas is produced from other reserves. The current Mining Act makes it not possible to explore for natural gas in the same license-area where natural gas is being actively produced by another operator. 300 prospects (75 bcm) are on acreage for which a production license is granted, but where the operator is inactive.

Concluding, many prospects are unavailable for exploration because they are on acreage where natural gas is being produced by other operators. To valorize the exploration potential, these producing firms must be stimulated to explore, or return the exploration license so that other firms can explore.

2. Plays and assets for new or extended production

Apart from exploring for new resources, firms can also invest in production plays and bring reserves in production. The figure 22 below indicates the market size for these production activities.

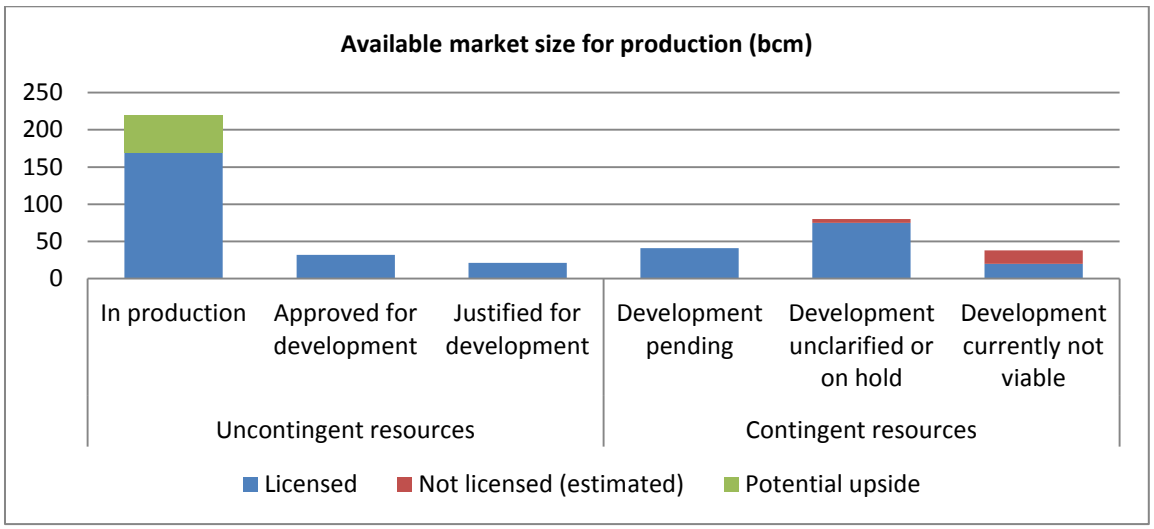


FIGURE 22: MARKET SIZE FOR PRODUCTION, WITH NOT LICENSED PRODUCTION PLAYS ESTIMATED (EBN, 2012:8)

The market size for new production activities (a total of ~380bcm, of which ~94% is licensed) can be segmented in 'brown field' projects and 'green field' projects.

Brown field projects concern reserves which are already being produced. New investors can acquire (equity in) an existing production activity and license. The reserves which already are being developed (first blue bar) comprise 170 bcm. This amount of reserves-in-production has a potential additional upside of ~50 bcm when production is extended or increased (green bar).

Green field projects concern proven reserves which have not yet been brought into production. These projects can be segmented in three categories. First, uncontingent resources which have not been brought on-stream by the license holder, but are approved or justified for development, (second and third blue bar) containing ~50 bcm. New investors might acquire (equity in) a license for these resources, although this is very unlikely. Secondly, *contingent resources* for which a production license is requested. These resources have not been brought in production because development is pending or unclarified, or for which development is currently not viable, (4^{th} – 6^{th} blue bar) containing ~136 bcm. New investors can acquire (equity) in a license for contingent resources which have not been brought on-stream because the current development is not viable. As different firms have other financial or technical requirements and criteria for 'viable', these contingent resources can possibly be 'unlocked.' EBN estimates that 50 bcm can be unlocked by technical and economical enablers (EBN, 2010). Thirdly, new investors can apply for a production license of unlicensed production reserves (red bars). These resources are contingent and comprise ~23 bcm.

Concluding, the attractiveness is negatively affected because of the low availability of assets for acquisition. Oranje Nassau Energie (ONE): "The availability of plays for production is frustrated because current operators are 'sitting on assets'." This problem was also recognized by other operators. To optimally valorize the potential upside, and unlock contingent resources, it is necessary that license holders are incentivized to increase their activities, or sell their assets to other firms.

LEVEL AND BASIS OF COMPETITION

A second determining driver for the internal rivalry is the level and basis of competition among firms. This competition can be segmented in competition for (equity in) existing licenses, and acquisition of (equity in) new licenses and competition between operators during exploration, production and operations.

1. Competition for licenses and equity in licenses

The availability of public information on competition and demand for equity in licenses is very limited. Based on industry interviews it was identified that the Dutch upstream industry is a 'buyers market' for (equity in) licenses and assets. The availability of (equity in) licenses and assets is, however, very low. Information about available (equity in) licenses and assets is also very low. The competition for licenses is therefore high, but not efficient and transparent (ONE).

2. Competition between operating firms

Compared to other production industries (e.g. refinery, automotive), producers of natural gas do not heavily compete on, e.g. a product-basis. The opposite is the case: producers of natural gas often co-benefit of other firms' successful activities. When the total amount of produced natural gas increases, the marginal costs of transportation and processing decreases for all firms. Also, when another firm successfully explores for prospects, or brings new reserves into production, the decommissioning of off-shore infrastructure will be extended. This has a positive effect on the 'window of opportunity' for all firms (EBN, 2011). Interviews with operators also validated that the level of competition between firms is low. Also, competition for access to infrastructure and processing facilities is low due to low utilization rates. This is a unique character of the Dutch E&P industry which need to be taken into account when addressing the sector.

INDUSTRY PHASE

Porter (2008) indicates that when industry growth is low, it precipitates fights for market share and pressures down the margins. The figure 23 below indicates that 43% of all fields are in tail-end phase. The large amount of mature fields also indicates that the current industry is in a mature to declining phase. Because of this development, the attractiveness of the Dutch upstream industry decreases caused by the decreasing possibility

of new projects and the increasing costs of operating mature fields. Moreover, new technological developments have created a 'new market,' namely the market for exploration and production of tough reservoirs. This may attract new firms to this market.

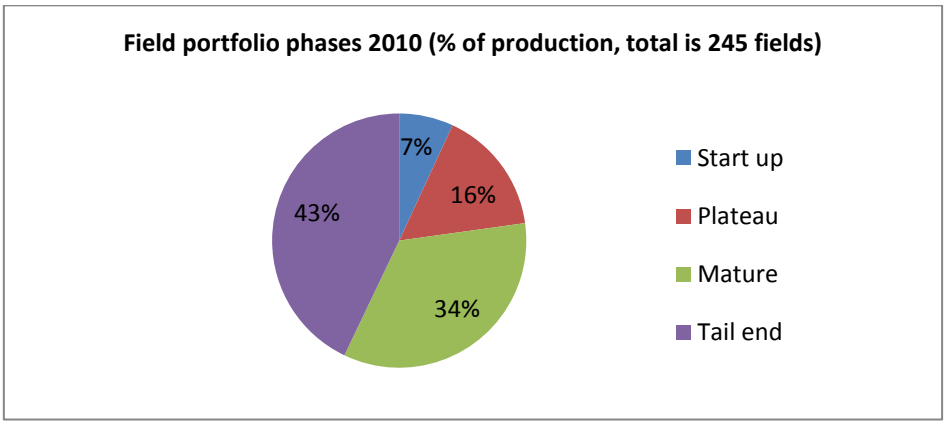


FIGURE 23: PRODUCTION PHASE (EBN, 2010:5)

6.1.1.2 CONTRIBUTION OF THE GAS ROUNDABOUT POLICY

As indicated in figure 20, the gas roundabout contributes to internal rivalry by adjusting the Mining Act and the fallow acreage covenant. EBN estimated that a total of 300 prospects are candidate for 'license withdrawal' or 'fallow acreage' (last orange bar in figure 21). Because of the gas roundabout policy, a significant amount of prospects is added to the available market size for exploration when the license holder declares the acreage 'fallow' or when the Minister decides to withdrawal the license. Successful stimulation of the 'fallow acreage' or enforcement of the Mining Act can therefore deliver a substantial contribution to the available market size for exploration plays.

The determine the possible effects of the adjustment of the Mining Act and the subsequent fallow acreage covenant, table 8 below indicates the results of a 'fallow acreage initiative' in the UK over the period 2002-2011 (DECC, 2012) and benchmarked these results for the Netherlands. Benchmarking with the UK is logically as the industry conditions and phase in the UK are quite comparable to the Netherlands (see appendix 6 for a more extensive insight in the benchmark performed for this study).

It can be concluded that there is a significant *potential* for the contribution of the fallow acreage covenant or adjustment of the Mining Act: adding 96 bcm over the period 2012-2030. It is necessary to closely monitor these developments, and possible opt for a more stringent regime (comparable to the UK) in order to realize the potential, as this is the case in the benchmarked situation of the UK.

Based on interviews with operators, some other important considerations must be noticed. An operator mentioned that the size of the 'fallow fields' are too small to realistically perform exploration activities. The current covenant does not subscribe to the size of a 'fallow field' (the Mining Act does in art.11). Another problem is that when a prospect is successfully drilled in a 'fallow field,' the producer or operator of the parent field often behaves opportunistically and demands a certain ownership of the prospect (ONE). The current covenant does not mitigate this opportunism, posing a serious hurdle to explore in 'fallow fields.' Another insight gained from operator interviews is that a 'vertical' licensing system, of 'vertical fallow acreage' would also be a good idea. This enables firms to explore for natural gas on acreage in which the current license holder is not interested or experienced in (e.g. shallow gas or gas in a shale-layer). Also the communication from out EL&I is identified to be sub-optimal (according to operator). Concluding, the contribution of the gas roundabout policy to the availability of plays has a large potential (see table 8), but the current mode and execution might to be revised to valorize this potential.

TABLE 8: FALLOW ACREAGE BENCHMARK, BASED ON APPENDIX 6

	UK (2002-2011) results	NL (9 years time) potential based on benchmark study
Regulation	Stringent regulatory regime for complete blocks or discoveries (see appendix 6)	Non-binding covenant for fallow acreage area's (see appendix 6)
Fallow definition	No significant activity for 3 years, thereafter license published on decc website, relinquished after 1 (blocks) or 2 (discoveries) years.	Non-binding, voluntary. Fallow acreage (sub-optimally) communicated (see more below)
Scope	Exploration (fallow blocks) Production (fallow discoveries)	Exploration and production (fallow acreage)
Exploration		
Number of blocks/exploration acreage relinquished	507	320
Number of blocks/exploration acreage relicensed	211	134
Exploration wells drilled on fallow blocks/acreage	122	77
Seismic surveys conducted on fallow blocks/acreage	17	10
New production projects on fallow blocks/acreage	33	20
Additional production (9 years)		**40 bcm**
Production		
Number of discoveries/production acreage relinquished	180	18
Number of discoveries/production acreage relicensed	76	7
Appraisal wells drilled	38	3
New seismic studies	11	1
New production projects on fallow discovery/production acreage	42	4
Additional production (9 years)		**8 bcm**
Total additional production potential by Fallow Acreage and adjusting Mining Act 2012-2030: 96 bcm		

6.1.2 ENTRY BARRIERS

This paragraph will address the second force. Porter (2008) describes entry barriers as hurdles for market-entrance or new investments.

6.1.2.1 INITIAL ATTRACTIVENESS

In the upstream industry, entry barriers can be categorized in technological-, financial-, regulatory-, knowledge- and social barriers for new investments. This perspective broadens the perspective to upstream investments, often limited to EMV or NPV analysis.

TECHNOLOGICAL BARRIERS

Technological factors, determined by geological and geographical conditions, are related to the size of the field, and the type of the field.

The figure 24 below indicates the differences in prospect size for the Netherlands compared to the six off-shore regions in the UK. On average, a UK prospect is 4,2 bcm compared to a Dutch 2,2 bcm. The size of the field determines the required size of investment, the associated resources (capital, personnel, etc.) and the expected revenues from the field. Depending on the available capital of a company, the size of a prospect

determines the attractiveness of the investment, together with the possibility of success (see below) (WoodMackenzie, 2000). In the Netherlands, on-shore prospects are on average bigger (40% >1 bcm) than offshore fields (20% > 1 bcm) (EBN, 2011:11). Of the stranded/contingent fields, 40% is on-shore (average size is 2.1 bcm) and 60% onshore (average size 1.0 bcm) (EBN, 2012:13)

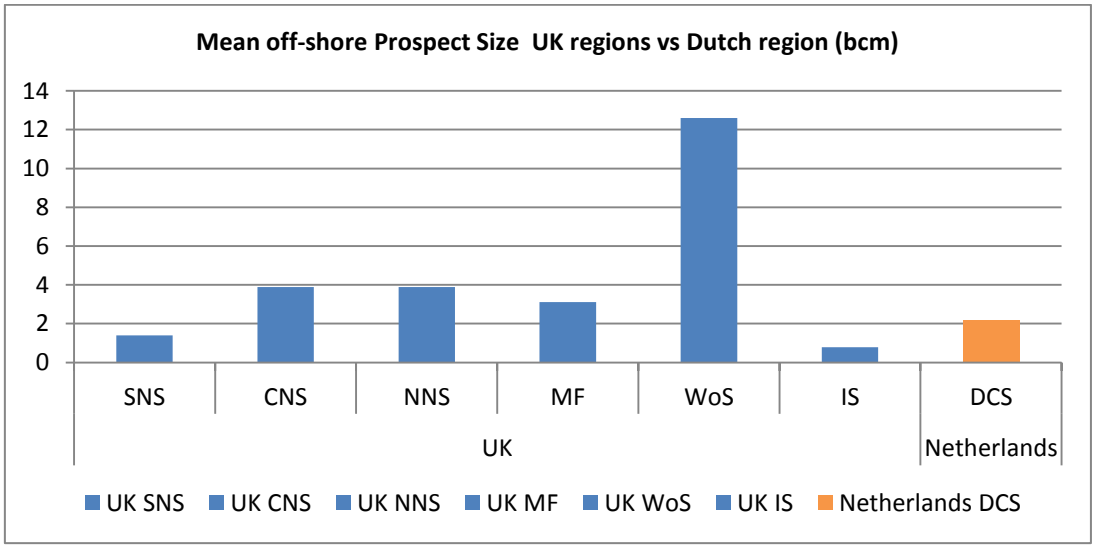


FIGURE 24: AVERAGE PROSPECT SIZE UK (SEGMENTED IN 6 AREAS) AND NL (SOURCE: KEMP AND STEPHEN, 2008:5 AND EBN, 2012:13)

A second technological factor is the *type* of field. Geological conditions determine the technical characteristics of the operations in terms of field-depth (shallow, conventional or deep), reservoir characteristics (permeability, porosity), rock-characteristics (tight sandstones, shales, coal beds, conventional rocks) and natural gas characteristics (e.g. gas quality) (EBN, 2011). Also geographical conditions characterize the type of fields. There is big difference between on-shore and off-shore operations. Additional challenging geographical conditions (e.g. arctic mining) also determine the attractiveness of a specific region for oil companies to invest. Based on an interview with senior TNO researcher Mr. Bos, it can be stated that the type of field to a large extent determines the inherent risks or operations and required capital.

Based on these technological factors, Dutch upstream activities can be sub-divided in the following type of projects:

TABLE 9: TYPE OF FIELDS (SOURCE BASED ON EBN, 2011; EBN, 2012, SOURCE: EZ, 2012:23 AND DE HAAS, 2007)

	On shore		**Off shore**	
	Conventional	Unconventional	Conventional	Unconventional
Size (EBN, 2012:13)	Small ~2.2 bcm	Unknown (approx large)	Small ~2.2 bcm	Small ~2.2 bcm
Reservoir depth	Conventional	Conventional	Conventional	Shallow
Rock characteristics	Conventional	Shale or tight	Conventional	Conventional or tight
Geographically challenging	Low	Low	Low	Low
Required capital for exploration	~ €15 million	Unknown (approx >>€15 million)	~ €20 million	~ €20 million
Required capital for production	~ €45 million	Unknown	~ €60 million	~ €60 million
Technical risks and uncertainty (apart from POS)	Low	High	Moderate	High

Approx share of past projects (-2010)	10 bcm/y 2000-2010 (33%)	-	20 bcm/y 2000-2010 (67%)	-
Approx share of total future projects (2010-2030)	11 bcm/y 2020-2030 (36%)	Tight 1 bcm/y 2020-2030 (3%) Shale 5 bcm/y 2020-2030 (16%)	12 bcm/y 2020-2030 (40%)	Tight 1 bcm/y 2020-2030 (3%) Shallow 1-2 bcm/y 2020-2030 (2%)

In general, the size and type of projects on the Dutch acreage are relatively modest in capital-size and the majority of the required future investments concern conventional technologies (76%). The unconventional investments are already being carried out in other parts of the world. Therefore, technological drivers do not have a negative effect on the attractiveness of the Dutch industry.

However, to determine whether these technological factors are actual hurdles for investments, they must be compared with strategy, resources and capabilities of the different firms. This will be done in section 6.4. Moreover, access to technological resources such as infrastructure, platforms and personnel – which can also have a significant impact on the attractiveness of the Dutch upstream industry – will be dealt with by the force 'bargaining power of suppliers.'

The last, and possibly most important driver for exploration activities, is the possibility of success – being the likelihood that an exploration drilling is successful. The table below presents the POS of different countries:

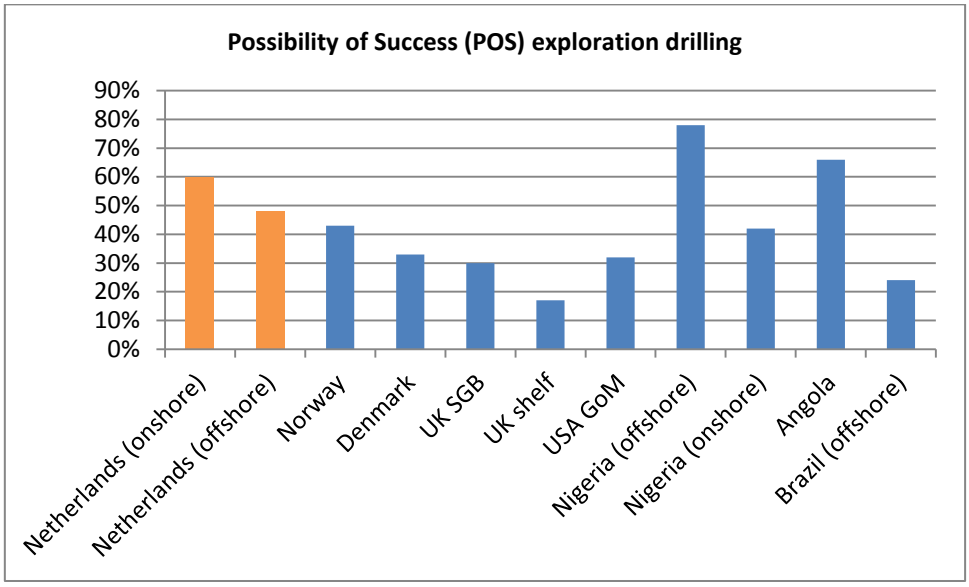


FIGURE 25: POS COMPARISON DIFFERENT COUNTRIES (WOODMACKENZIE, 2000 OVER 1991-2000)

In this regard, it can be concluded that the POS of the Dutch upstream industry is relatively good, resulting in an attractive upstream investment climate.

ECONOMICAL BARRIERS

The second entry-barrier addresses relates to economic elements. According to WoodMackenzie (2000), oil firms decide upon the economic attractiveness of an upstream investment climate by calculating the *expected monetary value* (EMV) for exploration engagements and the *net present value (NPV) after government take* for production engagements. Figure 26 illustrates these criteria for the Netherlands, compared with surrounding countries. However, comparing the Netherlands with other countries depends on the resources and capabilities of firms, as will be described in 6.3. Some firms compare exploration and production projects on a global scale, others are only interested in a limited number of countries and regions. As the global EMV ranges between -70 and 123 and the global NPV between 0.20 – 8.23, how can this study determine the attractiveness of the Dutch upstream investment climate? Certainly, these two criteria are leading-indicators. But for a thorough analysis of the economic entry-barriers, this study must go beyond these two criteria.

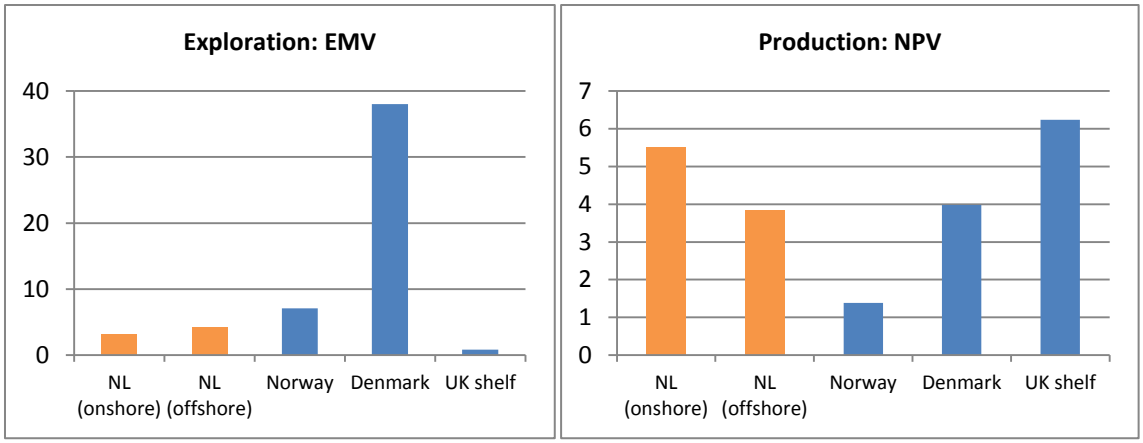


FIGURE 26: EMV AND NPV OF NL COMPARED TO SURROUNDING COUNTRIES IN 2000 (WOODMACKENZIE, 2000:20-24)

The figure 27 below indicates the margins of a cubic meter of Dutch natural gas in 2006 and 2011. In general, there are four economic factors which determine the attractiveness of an investment in terms of the economic elements: the capital expenditures for both exploration and production (capex), the operational expenditures for production (opex), the revenues (associated with the production) and the taxes. To analyze the economic elements driving the economic entry-barrier, this paragraph will emphasize on the capex and opex. Taxes will be described later, and the revenues will be dealt with by 6.1.4.

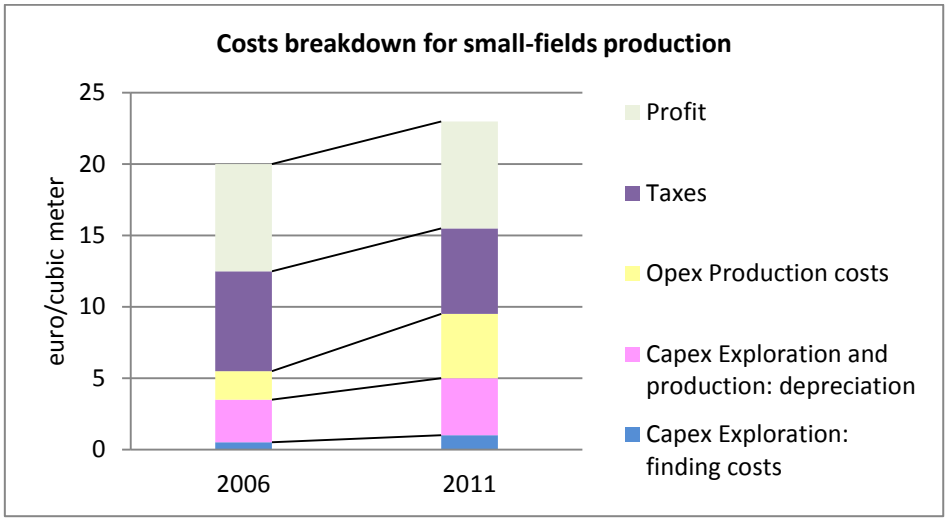


FIGURE 27: MARGINS OF SMALL-FIELDS PRODUCTION (EBN: 2012:31)

1. Capital expenditures (capex)

In addition to the EMV and NPV, capex can also form an entry barrier when the amount of capex required to engage in a project exceeds the capabilities of a firm in absolute terms. This entry barrier is strongly dependent on the resources and capabilities of the firm, as will be elaborated upon in 6.4. The *specificity* of the investment and required capex will explicitly be dealt with in 6.2. Figure 28 indicates the capex for exploration and production projects.

Exploration costs mainly comprise of capex: (i) the finding costs, (ii) the costs of hiring a drilling rig and (iii) other costs of the exploration well. In relative terms, the required exploration capex does not strongly depend on the size of the prospect, and with that the potential gains. Therefore, exploration investors make a risk-reward calculation between Dutch prospects and foreign prospects (EMV). Because of the small field-size in the Netherlands, the expected reward is relatively low compared to projects in countries with larger prospects (see WoodMackenzie, 2000). On the other hand, the high success-ratio of Dutch exploration activities makes the

Netherlands relatively attractive. Still, the impact of an unsuccessful exploration drilling is significant, especially for small operators.

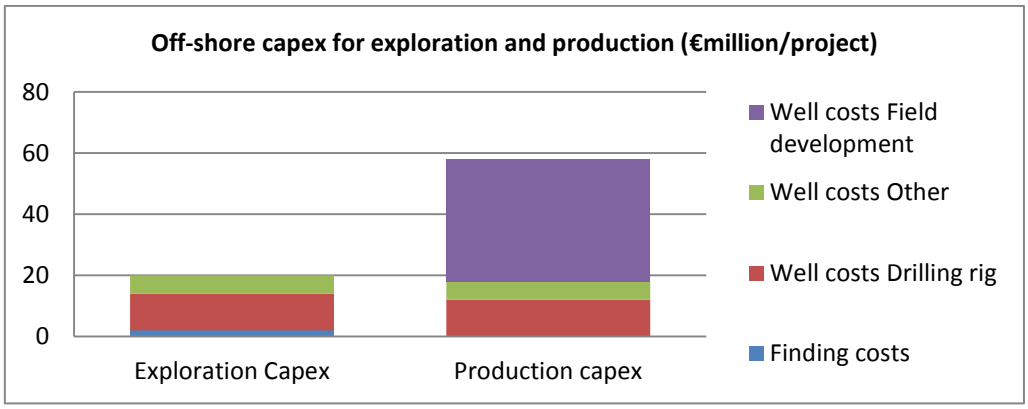


FIGURE 28: OFF-SHORE CAPEX FOR EXPLORATION AND PRODUCTION SOURCE: EBN, 2012 AND OWN CALCULATIONS

The capex for production (see figure 28) is determined by the required total size ('lumpiness') of the investment, depending on the size of the field. Because fields are relatively small in the Netherlands, the required capex for investments in exploration and production (threshold) is relatively low compared to other countries (field development costs). Production capex is depending on drilling- and other well-costs (€20 million/well offshore) and field-development costs (€ 40 million/field off shore). The capex is fed into the margin of natural gas by depreciation (majority of the pink bar in figure 27). Because the projects are of a relatively small size, this can be seen as a positive element of the attractiveness of the Dutch investment climate according to Porter's theory. The required capital does not form a specific hurdle for investment in the Dutch industry, depending on the companies' resources and capabilities as will de elaborated upon in 6.4. EBN (2012) indicates that it is expected that the production capex will increase over the coming years (EBN, 2012:35). This can be explained by the mature state of the industry, resulting in the need for relatively more (expensive) tail-end projects and more (expensive) tough or contingent projects.

2. Operational expenditures

Opex is only involved in production, represented as production costs (yellow bar) in the figure 27 above. The opex comprises of 5 categories, as illustrated in the figure 28 below.

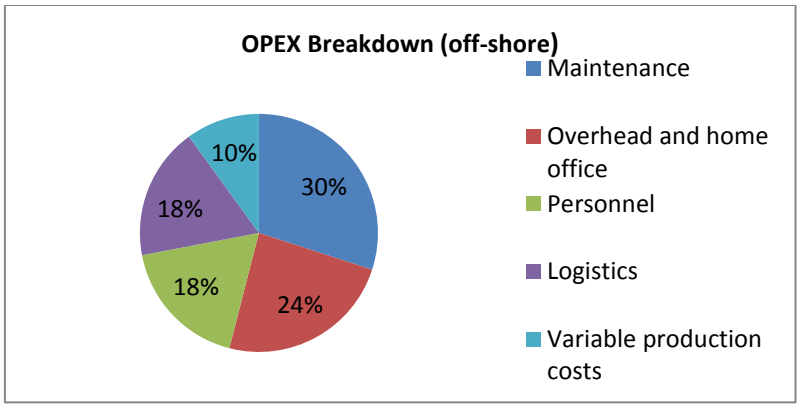


FIGURE 28: OPEX BREAKDOWN, SOURCE: EBN, 2010:8

The tariffs of opex are related to the oil-price because resources for natural gas production (personnel, logistics, etc.) compete with oil production elsewhere in the world. A high-oil price results in a larger demand on the global resource market, but is compensated by a higher return when the natural gas price is linked to oil. However, there is also a strong correlation between the two prices when natural gas is not linked to the oil price. The next paragraph will emphasize more on this.

Because only 10% of the opex is depending on the rate of production (light blue in figure 28), a declining production-rate increases the unit operating costs (UOC). Over the period 2002-2011, opex has increased with an average of 53%-109% (EBN, 2012). This increasing opex has a significant negative effect on the attractiveness of the Dutch upstream industry (ONE, NPN). Moreover, this attractiveness is also depending on the firm, as the overhead and home office opex (representing an average 24%) is significantly lower according to NOGEPA for smaller firms. Higher opex is derived from sub-optimal utilization of capacity, services and resources, or sub-optimal planning and bargaining with suppliers. Section 6.1.3 will emphasize more on this.

It can be concluded that the increasing capex and opex do not make the Netherlands particularly attractive for upstream investments. Although the POS in the Netherlands is high, the expected returns are limited due to the relatively small field size. This explains the relatively low EMV despite the high POS. As required exploration capex is (to a large extent) independent from the prospect size, the Netherlands is not very attractive according to exploration capex. As the required production capex in the Netherlands is relatively low, this makes the Netherlands attractive for investments. However, this capex is increasing due to the maturity of the industry. On the opex-side, the increasing costs do not make the Netherlands attractive for investments. Higher opex will result in a lower NPV. The mature phase of the Dutch industry will result in a continuing increase of the opex and capex, lowering the attractiveness of the Netherlands for upstream investments.

GOVERNMENTAL BARRIERS

The third entry-barrier relates to the Dutch government, involved in the upstream industry in multiple roles: as regulator and granter of licenses (by means of EL&I), as partner in the OvS (by means of the ownership of EBN), and as fiscal actor (tax collector and fiscal measures) (also see appendix 2). This section will address the factors which determine the attractiveness of the industry, related to government involvement.

1. Regulatory instruments: licensing by the Ministry of Economic Affairs and permitting by local authorities

Appendix 2 extensively elaborates upon the regulatory role of the Dutch government. The effect of this regulatory role of the Dutch government on the attractiveness of the Dutch upstream industry is discussed with several operators during interviews. In general, the regulatory climate in the Netherlands is perceived as stable, fair, clear and competitive with surrounding North-Sea countries. The regulatory uncertainty in the Netherlands is low, resulting in an attractive investment climate (i.a. ONE, NPN, Wintershall).

However, the procedures for requesting a license is perceived as ‘unnecessarily’ complicated. The current licensing regime is based on the principle that for all areas a license can be requests on any moment. Because this request for a license has to be published by the Netherlands and the European Union, this procedure takes about a year. After publication, other parties have the opportunity to also apply for this license. Depending on the other applications, the Dutch government (EL&I) grants the license. This procedure is perceived as ‘unpredictable’ and because other applicants for the license have public access to the content of the first license application (including technological concepts), they have the advantage that they can copy these concepts after this information is made public.

For on-shore activities, the permitting procedure is an important hurdle for investments (i.a. NPN). The number of permits and involved authorities form an important hurdle because this process is uncertain and can take a long time – especially due to possible public resistance (see Pikaar, 2011). An on-shore operator pointed at this striking difference between on-shore and off-shore activities. NPN: “On-shore, additional burdens related to permitting and associated public engagement are required. Even for exploration projects which might not even result in actual activities (studies, surveys), the lower authorities and public must be involved. This takes time, and is not compensated by e.g. lower licensing costs or longer durations of the license for study.” This has a negative effect on the attractiveness, as this might hamper operators to conduct studies. Easing the permitting procedures (e.g. by applying the *Rijkscoordinatie-regeling,* or establishing one agency for permitting), and more recognition for the difference between on-shore and off-shore activities can increase the attractiveness.

In addition to that, enforcing the Mining Act and guiding the Fallow Acreage covenant is indicated as sub-optimal by some operators. Limited capacity at the Ministry and sub-optimal design of these measures are put forward as possible explanations. More substantive involvement, information supplies, transparency and deployment of the regulation – with eye for possible new or additional measures – are demanded by the operators to increase attractiveness. It was indicated that lessons can be learned from Norwegian and British governments (i.a. Wintershall)

2. Ownership instruments: EBN

According to operator interviews, the role of EBN within the Dutch upstream industry is seen as stable and transparent. Signing an OvS with EBN is no threshold for operators to invest. During operations, the operators also indicate that EBN's role is a positive aspect of the Dutch regulatory regime. (i.a. ONE, NPN, Wintershall)

3. Fiscal instruments: tax, state-profit-share and fiscal measures

Operators have to pay taxes and state-profit share to the Dutch government (grey bar in figure 27, see EBN, 2012:30). Compared to other countries, the Netherlands does not have a very strict regime (see figure 29). The interviewed operators agree, by stating that they perceive the fiscal regime as 'fair and competitive.' (i.a. Wintershall) The current level of government-take does therefore not negatively contribute to the attractiveness of the Dutch upstream investment climate.

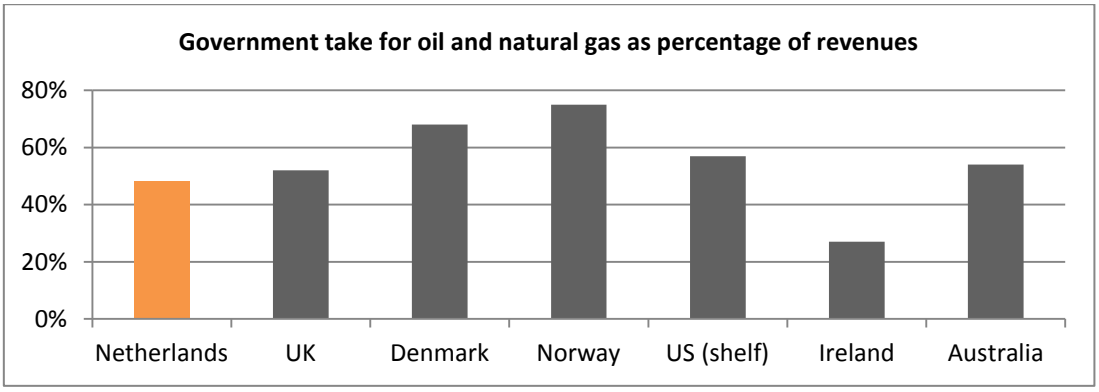


FIGURE 29: GOVERNMENT TAKE COMPARISON (SOURCE: JOHNSTON, 2008, FOR A MORE PRECISE PICTURE OF GOVERNMENT-TAKE IN THE NETHERLANDS SEE EBN, 2012)

KNOWLEDGE BARRIERS

The fourth entry barrier relates to knowledge. Apart from the operational core-business of operators - exploration and production - other activities are performed by firms: selling the produced natural gas, engage with other operators for resource-sharing, engage in research and development (R&D) to improve future operations and sustain competitive advantage, and engage with other stakeholders (government and public). The force 'bargaining power of buyers' will address the first activity (6.1.4), the force 'bargaining power of suppliers' will address the second activity (6.1.3), and the next section will emphasize on the need for stakeholder engagement. This section will emphasize on the required knowledge for exploration and production activities in the Netherlands.

In general, knowledge can be related to (EL&I, 2012):

- The subsurface: geological and geophysical knowledge which supports successful exploration and production activities and investments.

This knowledge is for a large extent publicly accessible by TNO and EBN. However, as has been identified during operator interviews, the availability and quality of data from underexplored off-shore acreage is lacking (i.a. ONE). Therefore, a large-scale 3D seismic survey has been performed by Fugro recently, financed by the Dutch government (Fugro, 2012). These initiatives deliver a positive contribution to the attractiveness of the Dutch upstream industry.

- Operations: related to producing natural gas safely and viable. Knowledge is related for production and reservoir management, well-integrity, operational performance etc.

Knowledge related to operations is present within firms. Developing new (patented) concepts for operations forms an important source for competitive advantage. Sharing of knowledge has remained limited within the upstream natural gas industry compared to e.g. Norway (OG21, 2010). Apart from health, safety and environmental concerns, the level of joint-knowledge building is limited (EL&I, 2012). More on this in 6.3.

SOCIAL BARRIERS

The Netherlands has a rich history with social factors which have an impact on the attractiveness of the upstream industry for investments. Examples are public resistance against drillings in the Wadden Sea, but also resistance related to the protection of marine life (Pikaar, 2011). Social barriers for permitting by lower governments (municipalities) might impact the location, delay the project or may even result in a cancellation of the project. NOGEPA (2012b) indicated that public acceptance might even be seen as the biggest treat for future on-shore E&P activities. NPN also indicated public resistance, resulting in delay of projects, forms a hurdle for their investments.

ORGANIZATIONAL BARRIERS FOR LICENSE-HOLDER

A last barrier relates to the joint-operating agreement (JOA). In the Netherlands, 65% of all exploration and production licenses (total 191) are operated in a JOA where one party is the operator, and other parties are non-operating license holders (NOV). The other 35% of the licenses comprise only one party (NLOG, 2012). There are possible explanations why firms prefer operating a license with other parties, or single. Firstly, the size of investment and firm's resources and capabilities determine the preferred mode of governance. Because of certain capital constraints, some firms are obliged to decide upon a JOA mode of governance to attract additional capital resources. Secondly, firm's strategy also plays an important role in their attitude towards uncertainty and their preferred mode of governance. Thirdly, environmental uncertainty (see 5.5.1.2) is an *explaining factor* for the modes of governance. To mitigate the environmental uncertainty related to dry-hole drillings (at off-shore exploration drillings), infrastructural decommissioning (at off-shore production) and other drivers for uncertainty (policy to always have shared-equity in many JOAs to spread risks and uncertainty), firms decide upon JOA governance. Large firms (e.g. Shell, BP) have the possibility to mitigate many uncertainties (e.g. dry-hole risk) in-house (e.g. large exploration portfolios) these firms might have another attitude towards environmental uncertainties compared to firms who do not have in-house mitigation possibilities. 6.3 will provide more insight on this.

The presence of sufficient NOVs, and possibility to act as NOV – which can be used to mitigate or spread uncertainty and overcome investment thresholds – is therefore an important factor of the attractiveness of the upstream investment climate. Based on NLOG data, it was identified that the number of NOVs increased over the period 2006 – 2010, from which can be deduced that the upstream investment climate is sufficient for them.

6.1.2.2 CONTRIBUTION OF THE GAS ROUNDABOUT POLICY

As illustrated in figure 20, the gas roundabout policy contributes to the entry barriers by means of the marginal investment allowance, adjustment of the Mining Act and Fallow Acreage.

The adjustment of the Mining Act and the fallow acreage covenant had a positive impact on the availability of plays (see 6.1.1.2), but can also form a hurdle for investments as it is related to the 'regulatory barrier.' For companies who are not capable to perform activities or investments within 2 years, their license-area can be decreased in size (Mining Act art. 32). This contribution depends on the type of firm, as will be elaborated in 6.4, but can especially harm on-shore firms as indicated above.

A second contribution of the gas roundabout policy is the marginal investment allowance (see 2.3.3). The measure positively contributes to exploration and production activities by lowering the barrier *capex*. This has a positive effect on the attractiveness of project in terms of their NPV as indicated in figure 30:

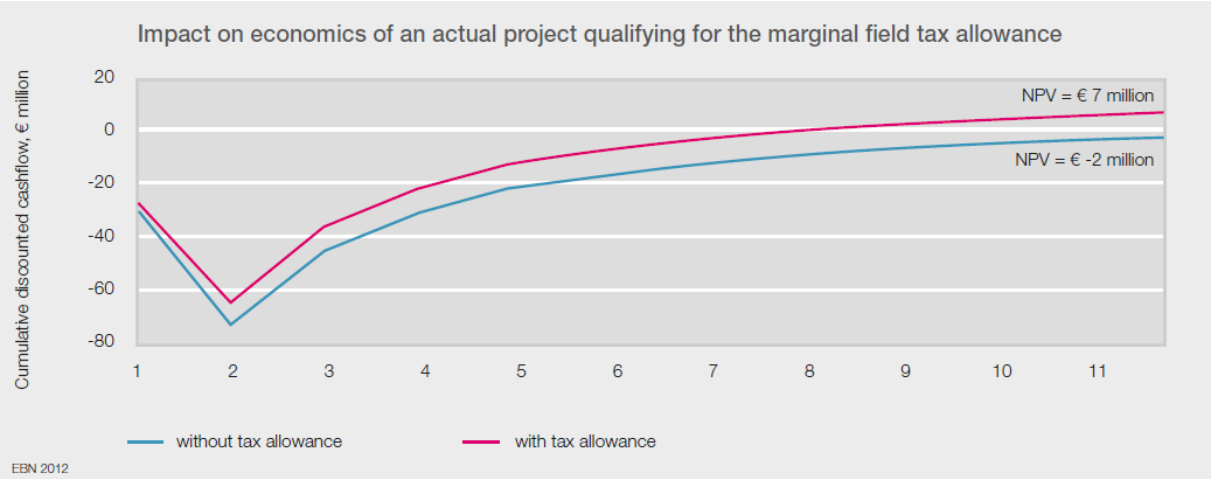


FIGURE 30: EFFECT OF MARGINAL INVESTMENT ALLOWANCE (EBN, 2012:32)

For exploration, the impact of a dry-hole drilling is reduced by the measure, as the state will cover 80.5% of the costs (40% by EBN), and the license holder only 19.5% - where in the old situation the license holder would cover 60% (EBN, 2012:32)

It was estimated that the impact of this measure is 25 bcm of additional off-shore natural gas in the period 2010-2030, of which 10 bcm is stemming from additional exploration and production of new reserves, and 10 bcm is stemming from contingent resources of "compartments." A total 5 bcm can be subscribed to additional investments in tail-end production (EL&I, 2012c).

The measure does not subscribe to on-shore activities. Moreover, operator interviews pointed out that opex is another important other hurdle for investments. (i.a. Wintershall) The gas roundabout policy does only focus on off-shore capex, and could also be applied for on-shore fields on the same grounds of argument. Even more important can be a reduction of opex. Another possible instrument is to allow a fiscal incentive for tail-end technologies or tough-gas investments, as it would stimulate these (necessary) projects – characterized by higher opex and capex – fiscally.

6.1.3 POWER OF SUPPLIERS

This paragraph will address the power of suppliers. Porter (2008) states that powerful suppliers capture more of the value for themselves by charging higher prices, limiting quality or services, or shifting costs to industry participants. Suppliers can therefore squeeze profitability or threaten by forward integration (Porter, 2008). The latter is not likely for service companies or infrastructure owners, but it is certainly possible that the suppliers of critical resources, capabilities and services can squeeze profitability.

6.1.3.1 INITIAL ATTRACTIVENESS

Infrastructure access and resources (rigs for drilling and staff for operations) are seen as the two main critical supplies to the upstream investment climate.

INFRASTRUCTURE

Access to critical infrastructure (pipelines for tie-in and platforms) is only an issue off-shore. Infrastructure access determines the window-of-opportunity to bring a prospect on-stream, and the tariffs for transport and processing on the platform is either fed into the depreciation (capex) or in the production costs (opex) of the project. As shown in figures 31, the ownership of platforms and pipelines is heterogeneously distributed among firms. The vast majority of the platforms and pipelines are owned by large (30-40%) and medium (60-50%) companies. New fields are connected to these pipelines and infrastructures for tie-in to the market.

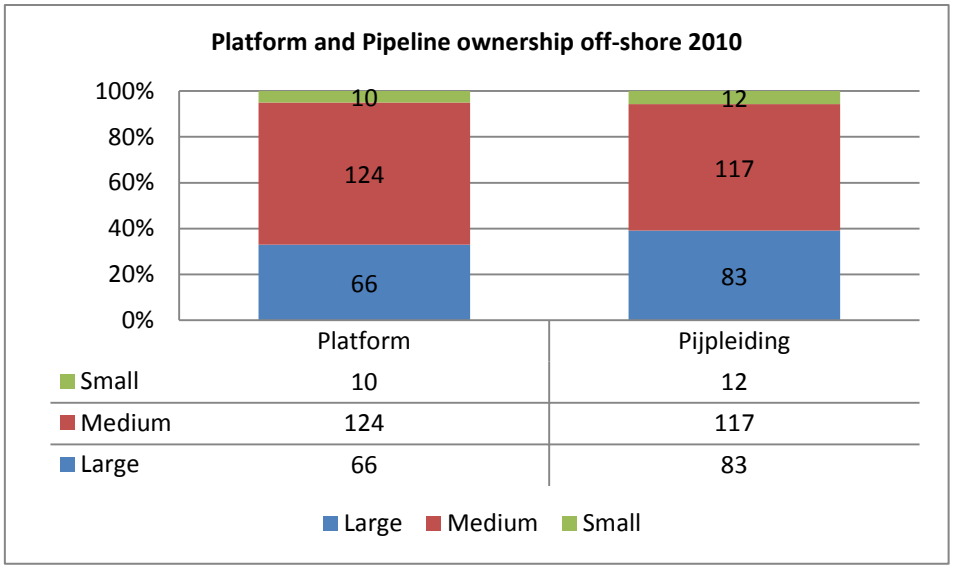


FIGURE 31: OWNERSHIP PLATFORMS AND PIPELINES (SOURCE: NLOG)

After the natural gas is transported by pipelines, and processed on platforms, the natural gas is connected to the off-shore transmission infrastructure (NOGAT, NGT or WGT), after which the gas is connected with the on-shore transmission system, operated by GTS. Ownership of these off-shore transmission pipelines is distributed according to figure 31b below. 40% of the infrastructure is owned by independent third parties, or EBN. The remaining 60% is owned by large (17%), medium (40%) and small (3%) operators of off-shore exploration or production licenses.

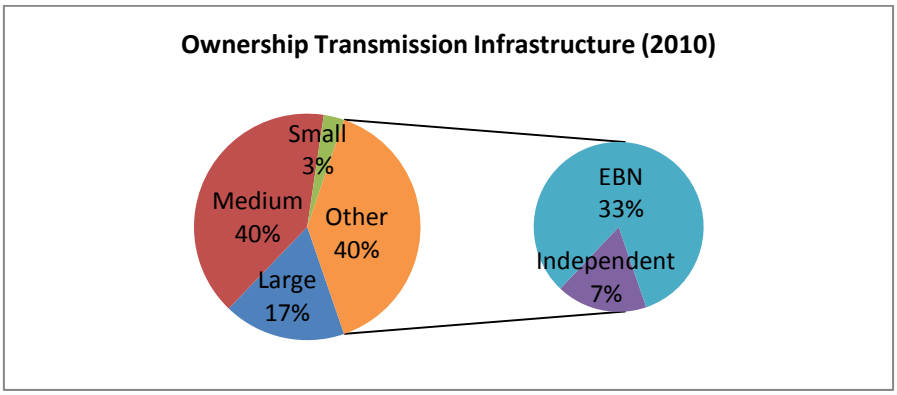


FIGURE 31B: OWNERSHIP OF TRANSMISSION INFRASTRUCTURE (SOURCE: NLOG)

Ownership matters, because the owners of the infrastructure decide upon access-conditions, tariffs and decommissioning. Although the average utilization rate of infrastructure and processing facilities is low (see EBN, Focus on Dutch Gas 2011), Wintershall stated that: “The competition for access to infrastructure depends on the volumes of developed gas within the catchment area of the infrastructure, and who is the owner or operator.” The owners are financially incentivized to delay decommissioning of depreciated assets until the moment that the costs of operating the infrastructure exceed the revenues from the tariffs, under the condition that this decommissioning would not result in lost tie-in conditions for prospects or reserves which are owned by the infrastructure operator.

The power of infrastructure suppliers is twofold. Firstly, infrastructure owners can charge excessive tariffs for using their infrastructure. As producers often have no (cost-efficient) alternatives, the infrastructure suppliers can squeeze the margins of the producer. In addition to that, the infrastructure owner can complicate operations (volumes and flexibility) by posing infrastructural access constraints. This may come at the expense of the producer, and requires costly safeguarding. Because the focus of this study is related to the contribution of the gas roundabout policy, additional research – using TCE for example – can create additional insight on this

issue, and the possible need for regulation of this infrastructure. A hybrid form of regulation can be co-ownership of EBN, which results in more control over the conditions. Further research is required to substantiate this though. Operator interviews results in different perspectives to this issue, as some indicated that off-shore infrastructure conditions and tariffs do not negatively influence the attractiveness of the Dutch upstream investment climate – and other argued the opposite.

A second potential power of infrastructure suppliers relates to the *shadow of decommissioning.* Figure 32 below indicates that many prospects would lose their primary tie-in point within a few years. Given the fact that 75% of the fields are in mature or tail-end phase, drilling for new reserves and cost-effective tie-in of (especially small) new fields are highly dependent on the availability of infrastructure (EBN, 2010: 7). Availability of infrastructure can be increased by reducing the opex involved with transportation and processing, but more significantly by adding more new fields to the infrastructure. When prospects or reserves do not have a viable tie-in route, they will become stranded. Developing more prospects and reserves increases the utilization rate of the infrastructure and with that the viability for the infrastructure operator to extend the lifetime of the infrastructure. This clearly shows the interdependence between exploration, production and infrastructure. The 'window of opportunity' for a viable tie-in of new prospects is at stake, negatively influencing the attractiveness of the Dutch upstream investment climate.

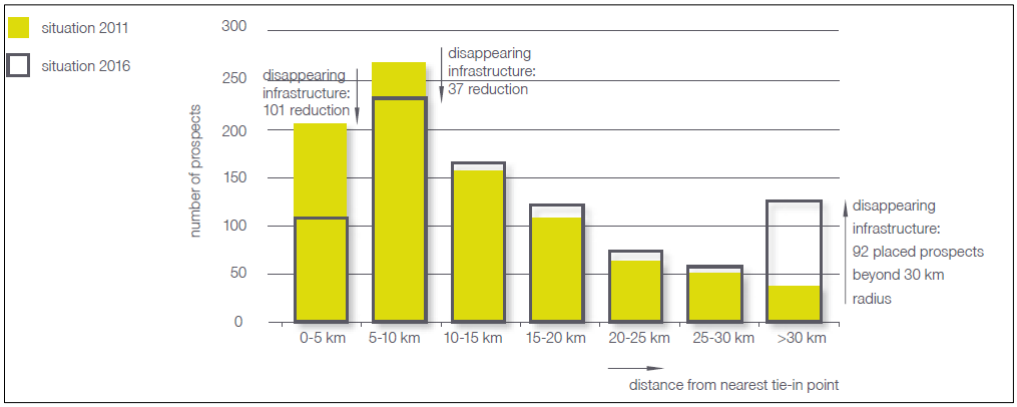


FIGURE 32: THE SHADOW OF DECOMMISSIONING (SOURCE: EBN, 2011:29)

RESOURCES

Operator interviews identified that competition for human resources, drilling rigs and other sub-contractor activities is *tight* (i.a. ONE). This competition has a negative impact on the duration of projects, as the waiting time for e.g. rigs is often very long, negatively contributing to the attractiveness of the upstream investment climate.

1. Rigs

Supplies of resources to the Dutch oil and gas industry is very extensive (see IRO, 2012). Numerous Dutch companies are involved in supplying resources to the producers of natural gas. One of the most crucial resources are drilling rigs. These rigs are hired by producers for rates ranging from a daily $50.000 (2005) to $200.000 (2010). Depending on the challenge of the reservoir, a rig is hired between 30 and 120 days (EBN, 2012:38). The European rig-market is dominated by 2 big global contractors (Noble and Transocean), who own half of all the rigs for the European market and 7 other contractors (e.g. Ensco, Maersk) own the other half. According to Porter (2008), these companies are in the position to 'squeeze profitability' because Northwest Europe (NWE) is only a modest market for their activities. These international contractors are active in 6 other regions (e.g. US GoM, West-Africa, Middle-East, Asia Pacific) which make up 90% of the rig market.

The figure 34 below indicates the daily rig price and utilization rate over the past 10 years. In the Netherlands only jack-ups are used (purple line). Using jack-ups result in lower drilling costs compared to regions where semi-subs or deep-water rigs must be used due to deeper water depths. Although the utilization rate of rigs in NWE is relatively low (see figure 34 below) – ranging between 10%-25% - operator interviews have identified

that access to rigs is an important hurdle for exploration and production drillings. ONE: "The average waiting time for drilling time is very long, and the available information about drillings by other firms is limited. This hampers the possibility to increase allocative efficiency, planning-optimization and resource-sharing."

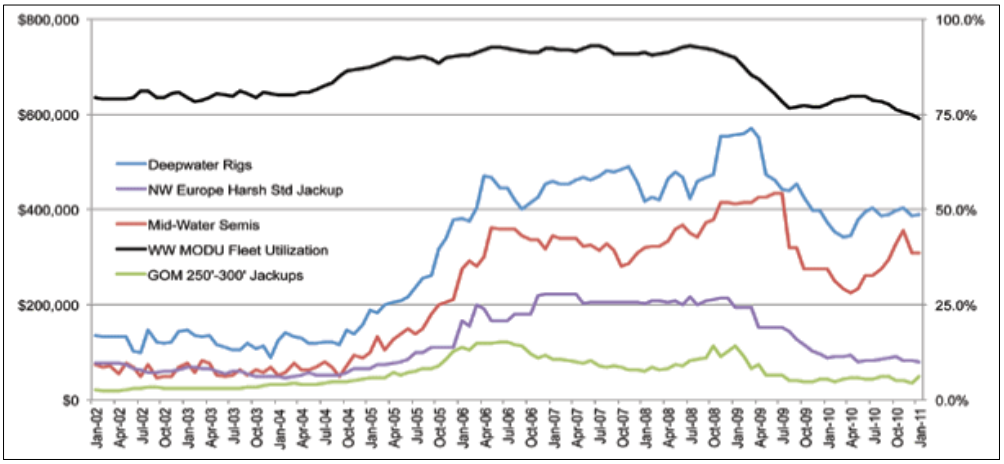


FIGURE 34: UTILIZATION RATES AND PRICES 2002-2011 SOURCE: ODS PETRODATA

The demand for rigs is strongly correlated to the gas price and the oil price (EBN, 2012). When the oil price is high, a bigger share of rigs will be used for oil drillings, and less for natural gas drillings. Section 6.4 will come back to this.

2. Staff

Operator interviews also pointed out that the availability of qualified staff is becoming a problem for small companies. Staff rates have increased over the years 2003-2008 (+54%), but not as hard as other opex components (average +75%) (see EBN, 2012). The availability of staff and other resources is also depending on demand and supply of both oil and gas. A higher oil price results in a higher demand for additional production resources and services, and a higher rate of production. Operator interviews pointed out that the supply market for staff is becoming more tight. This gives those suppliers a potential bigger power (i.a. ONE).

6.1.3.2 CONTRIBUTION OF THE GAS ROUNDABOUT POLICY

The gas roundabout policy does not contribute to the power of suppliers, as indicated in figure 20.

6.1.4 POWER OF BUYERS

According to Porter (2008), powerful customers can capture more value by forcing down prices, demanding better quality or more service (thereby driving up costs), and generally playing industry participants off against each other, all at the expense of industry profitability (Porter, 2008:7).

6.1.4.1 INITIAL ATTRACTIVENESS

According to Porter's theory, the power of buyers is depending on their bargaining leverage and their price sensitivity. To a large extent, the power of buyers will be addressed in 6.2. This paragraph will apply Porters' theory and focus on the most important 'sales dimensions' according to Porter (2008).

BARGAINING LEVERAGE

The number of buyers and the volume that these buyers actually buy determines their bargaining power. Porter: "Large-volume buyers are particularly powerful in industries with high fixed costs, such as offshore drilling. High fixed costs and low marginal costs amplify the pressure on rivals to keep capacity filled through discounting." (Porter, 2008:7) The potential power of buyers is large because of the standardized products, low switching costs, and the low threat of backwards integration. According to these criteria, the potential

bargaining leverage of buyers is very large – as almost all natural gas is sold to one buyer (GasTerra) in the current situation (see figure 36).

PRICE SENSITIVITY

According to Porter's theory, buyers of natural gas (commodity traders, utility companies) will be very price sensitive because the natural gas represents a significant share (if not all) of their costs, margins of buyers are low. Also, the quality of the bought product is not affected by the quality of the industries product (Porter, 2008). As will be described in section 6.2, this is more complex in the actual situation of selling natural gas. Producers are remunerated by mutually agreed prices (by long-term contracts or on the exchange), and do not *set* the price as e.g. car manufacturers charge a price to retailers. Section 6.2 will point out that selling natural gas to midstream buyers is an important dimension to determine the attractiveness of the industry, but that the bargaining leverage and price sensitivity are less important than factors such as uncertainty about demand and price. This clearly indicates the added value of the pluralistic theory of the firm. Section 6.4 will also come back to this.

6.1.4.2 CONTRIBUTION OF THE GAS ROUNDABOUT POLICY

The gas roundabout policy contributes to the power of buyers by the development of a physical and virtual hub. This will result in new structures between the producer and the buyer, as indicated in chapter 2. As the factors indicated by Porter are less relevant than issues which are addressed by section 6.2 (uncertainty about price and demand), the contribution of the gas roundabout policy to the power of buyers will be reflected on in section 6.4, where insight from section 6.2 can be combined with Porter's presumptions.

6.1.5 THREAT OF SUBSTITUTES

According to Porter (2008), a substitute performs the same or a similar function as an industry's product by a different means. Substitutes limit profits and reduce the bonanza an industry can reap in good times (Porter, 2008):98).

6.1.4.1 INITIAL ATTRACTIVENESS

Natural gas has a similar function as alternative primary energy sources such as coal, renewable energy sources (RES), nuclear energy and oil. It provides an input for mechanical work, electricity, heat and cooking (IEA, 2008). The total demand for primary energy sources and the share of natural gas within this demand is referred to as the total 'market size' of natural gas in the Netherlands. Within this total demand for natural gas, different supplies of natural gas compete for 'market share.' Indigenous production, pipeline imports from e.g. Russia, Norway and Algeria and LNG all serve the same market for natural gas demand.

MARKET SIZE NATURAL GAS IN DUTCH ENERGY-MIX

To determine the possible substitutes for natural gas, the figure 34 below identifies the expected segmentation of natural gas demand for the period 2010-2030 for the Netherlands (EFNL, 2012:38). In a 'business as usual scenario' for the Netherlands, the overall demand is 52 bcm annually. Based on three alternative pathways towards a low-carbon energy system in 2050 (CCS-dominated, an optimized mix, and a pathway dominated by nuclear energy and renewable energy resources), the total demand for natural gas can drop to a minimum of 45 bcm annually (see EFNL, 2012).

Compared with substitute fuels such as coal, renewable energy resources or nuclear energy, the future role of natural gas is less depending on the actual pathway for two reasons. First, the flexibility of natural gas makes it 'crucial in the journey towards a sustainable country' (EFNL, 2012:37). Natural gas could act as a back-up for intermittent power generation such as wind energy and solar PV (EFNL, 2012:37), and it could also accommodate high energy intensities during peak demand. Alternative fuels for the power sector do not have the physical capabilities to perform this flexibility function. However, when power storage technologies (e.g. batteries, compressed air energy storage) mature, they can take over this flexibility function of natural gas.

Secondly, natural gas contributes to security of supply for the Netherlands. The available gas supply and the reliability of the gas network puts the Netherlands in an excellent position to use gas for power, export natural gas, or overcome implementation issues (in case of a large green-, CCS-, or nuclear-transition) (EFNL, 2012:38).

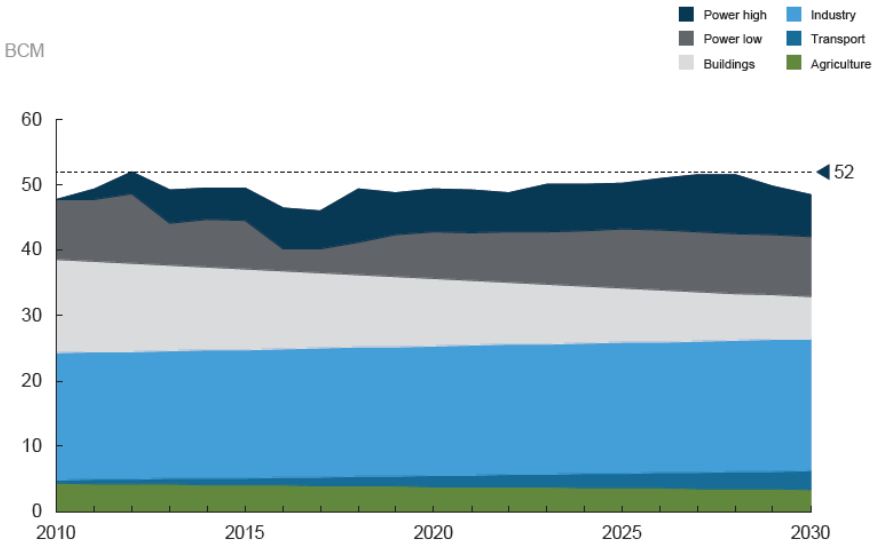


FIGURE 34: EXPECTED MARKET SIZE OF NATURAL GAS, DEMAND IN THE NETHERLANDS (SOURCE: EFNL, 2012:9)

Apart from these pathways, based on energy demand, emission and prices, also the social dimension plays an important role. The extent to which governments and consumers prefer gas on moral grounds also determines the role of gas in the future energy mix. Aspects like 'energy literacy' and the public perception about the importance of natural gas for security of supply and the economy can deliver a positive contribution to the social dimension. Despite all these uncertainties, this study assumes that the Dutch demand for natural gas over the period 2010-2030 will remain stable between 45 and 52 bcm annually.

MARKET SHARE OF INDIGENOUS DUTCH PRODUCTION IN DUTCH GAS-MIX

The total annual gas demand of ~50 bcm in the Netherlands can be supplied from different sources. However, the market share of Dutch natural gas can also be perceived within the wider Northwest European (NWE) context. CIEP (2011a) estimated the total annual demand for NWE to be ~250 bcm/y in 2010, 260-320 bcm/y in 2015 and 225-325 bcm/y in 2020 (CIEP, 2011:10). This demand can be supplied from different sources:

- Indigenous Dutch production, being Groningen gas (50 bcm/y in 2010-2020, 20 bcm/y in 2030) and small-fields gas (potential 30 bcm/y 2010-2030). Also, indigenous production from the UK (41 bcm/y in 2010-2015 and 30 bcm/y in 2020) and Germany and Denmark (18 bcm/y in 2010-2015 and 12 bcm/y in 2020) serve demand.
- Pipeline imports from Russia and Norway, which supply the Northwest European market with an annual 180 bcm/y for the period 2010-2020 (CIEP, 2011:25)
- LNG imports from GATE-terminal (12-16 bcm/y), possibly extended by another LNG-terminal at the Eemshaven (12-16 bcm/y) (Brattle, 2010). For the Northwest European market, a total LNG import capacity of 73 bcm/y in 2010, and an expected capacity of 91 bcm/y in 2020.

So, the annual supplies to the NWE market have the potential to be bigger than the annual demand. Such a situation will of course not mature. In a situation where the demand is met by supply, pipeline- and LNG-capacity will not be used completely. Because of the seasonal flexibility in demand, the total supply-capacity has to be bigger than the average demand. Nonetheless, this study will not concern such flexibility issues; reference is made to CIEP (2011a).

Figure 35 below illustrates that Dutch indigenous production competes with other supply sources to meet the NWE market demand. Also, the figures illustrates that the total NWE indigenous production is expected to

decline, and that the growing demand for gas in NWE has to be met with import gas to a bigger extent in the future. Therefore, the market-share of Dutch indigenous production can be expected to decrease. Of course, this is no problem for producers of Dutch natural gas when they can realize the potential production levels of 30 bcm until 2030. Other supplies only form a 'threat of substitute' for Dutch natural gas when these levels of production cannot be realized because other supplies are more competitive than Dutch natural gas supplies for the buyers on the market. The most important criterion is the price of the different gas supplies.

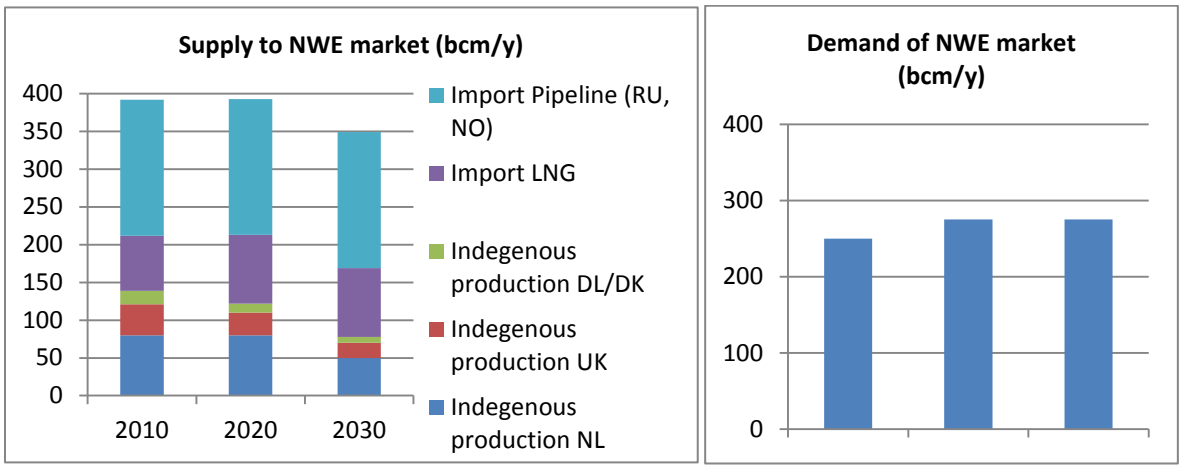


FIGURE 35: ROLE OF DUTCH GAS IN NWE GAS SUPPLIES, RELATIVE TO DEMAND SOURCE: CIEP, 2011:25

The threat of substitute supplies will mature when Dutch natural gas will be pushed out of the 'merit order' on the European markets. With the current price-levels, this treat is very limited. However, some developments can be drivers for these treats:

- Large supplies of LNG to the European market with a lower price level than Dutch natural gas. This can be caused by even lower LNG prices in other markets, such as the US, Asia or the Middle-East;
- Large supplies of pipeline imports to the European market with a lower price level than Dutch natural gas;
- Large supplies of indigenous production added to the European market, with a lower price level than Dutch natural gas. The biggest treat is low-prices shale gas from Poland, France or Germany.

These threats are limited because shale gas production is still very mature and is expected not to reach European markets on a large scale before 2030, and production from Russia and Norway is more expensive on European markets due to transport-costs. When LNG prices drop significantly on a global scale, these supplies will go to the market with the highest prices. Because numerous uncertainties are involved with these developments, additional research is required to substantially address the treat of substitutes in the future. Because of its very small potential and starting development, green gas is left outside the scope of this study.

6.1.4.2 CONTRIBUTION OF THE GAS ROUNDABOUT POLICY

The gas roundabout policy contributes to the threat of substitutes by developing a physical hub – which enables competing gas supplies to physically reach the market – and a virtual hub – which enables competing gas supplies to compete with Dutch natural gas on a gas-to-gas basis.

Additional gas streams from other countries (e.g. Russian and Norwegian gas by pipelines, LNG from Qatar and shale-gas from Poland) are expected to be physically transported to the Dutch gas hub. The majority of these gas streams will be transported as transit-streams (Brattle, 2010). Also, a part of these additional gas streams from other countries will also be traded on the virtual Dutch gas hub TTF (Brattle, 2010). In this respect, the current buyers of gas produced from Dutch fields will get more choice of supplies. It is therefore expected that the produced Dutch natural gas will get more competition from other gas streams, caused by the movement towards a physical gas hub (Brattle, 2010:13). However, GasTerra's off-take guarantee will ensure a future

certain level of demand for Dutch natural gas, against market-conform conditions and prices (see 6.2). Maintaining a strong position of GasTerra as buyer will continue the possibility to offer these conditions to small-fields producers (EZ, 2011).

6.1.6 CONCLUSION

Porter's theory indicates the attractiveness of an industry, by looking at the structure of the industry along five forces that determine the profitability of an industry. This paragraph elaborated upon these five forces for the attractiveness of the Dutch upstream industry, and identified how the gas roundabout policy contributed to these forces. Apart from the contribution of the gas roundabout policy, also other relevant elements – determining the attractiveness, but not affected by the gas roundabout policy – were explored for.

The Dutch upstream industry has the potential to be attractive for investments

The Dutch upstream industry is attractive because the potential market size for exploration and production is significant. The potential upside for brown-field production is significant and attracts companies who are aimed to valorize this upside in a maturing industry. Moreover, the focus on tough reservoir exploration and production has opened a new market for new companies. Technological drivers do not form entry-barriers for future investments, and the POS-ratio is sound compared with other countries. In addition to that, the required capital for investments in the Netherlands is relatively modest compared to other regions. The role of EBN and current regulatory regime is perceived as positive and fair among interviewed operators. The treat of substitutes for natural gas as primary energy source is low compared to other fuels (coal and renewables).

The gas roundabout policy positively contributes to the attractiveness of the Dutch upstream investment climate…..

The gas roundabout policy has the potential to positively contribute to the available plays for exploration and production by the fallow acreage covenant. Benchmarked with the UK fallow initiative, a successful deployment of such a policy instruments has the potential to result in significant additional exploration and production activities of around 96 bcm (see table 8). The marginal investment allowance is expected to deliver a substantial contribution to the attractiveness of the Dutch upstream industry – limited to off-shore activities – and potentially results in 25 bcm of additional off-shore production. The development of a physical and virtual hub has an impact on the bargaining power of buyers, but this is more extensively addressed in chapter 6.2. The small-fields policy is also addressed in that chapter.

….although some forces still point at the wrong direction

Although the gas roundabout policy contributes to the attractiveness of the Dutch upstream investment climate, some forces still point at the wrong direction. A total amount of 230 bcm must be added, and – as stated above – the current gas roundabout policy maximally adds 121 bcm. The remaining 109 bcm can be valorized by market parties, when the Dutch government investigates additional measures to mitigate the residual investment hurdles.

A first residual investment hurdle is derived from the actual availability of plays for exploration. This availability is limited because many of the prospects are on acreage where natural gas is produced, and the producer does not engage in exploration activities. Based on industry interviews, the current fallow acreage covenant is seen as sub-optimal because it cannot be enforced, the declared 'fallow' area's are too small, or the parent (producing) license holder behaves opportunistically. This observation threatens the contribution of the gas roundabout policy and must be mitigated. Also, more stringently enforcing the Mining Act can result in significant advantages when looking at the UK example of the role of DECC – where a more hybrid form of fallow acreage exists (see appendix 6).

A second investment hurdle is related to the limited the availability of plays for production, because license-holders are *sitting on assets* (brown-field projects) or licenses (green-field projects). Without stimulating the current license holders to improve their level of activity (e.g. oblige them to apply tail-end technologies), or stimulate them to sell their licenses, the potential upside for tail-end production or contingent resource

production will be under valorized. Where certain reserves are 'contingent' for certain operators, other operators might have the resources and capabilities to actually bring these reserves into production more cost-effectively. Chapter 7 will propose a possible measure which can mitigate this investment hurdle.

A third investment hurdle originates from the increasing opex. This increase is caused by the changing industry context, with more tail-end and marginal small-field production. The gas roundabout policy is not aimed to mitigate this development. The next chapter will propose possibilities for the government to contribute to reducing opex. Although it are the market parties who have to take actions to reduce costs, the government can play a stimulating role.

A large set of possible investment hurdle is related to on-shore exploration and production. Firstly, the marginal investment allowance does only benefit off-shore exploration and production. Extending the measure to on-shore activities would also result in a significant impact on the attractiveness of on-shore exploration and production investments. Secondly, the permitting procedures, involving local authorities, are very uncertain for on-shore activities. Thirdly, the need for additional on-shore activities has increased the social drivers as entry-barriers. Especially on-shore unconventional exploration and production activities face entry-barriers because of public resistance.

Moreover, the power of suppliers is a significant driver for the attractiveness of the Dutch upstream industry. Currently, the power of suppliers is very large. With regard to off-shore infrastructure (pipelines and platforms), the 'shadow of decommissioning' gives the suppliers of these infrastructural services significant power. It is recommended that EL&I investigates the opportunity to regulate the infrastructure, or take equity in smaller pipelines and platforms, in order to decrease the 'shadow of decommissioning' and the associated uncertainty, and to regulate the tariffs.

The need for a paradigm shift?

Almost all of the residual investment hurdles – being factors which negatively contribute to the attractiveness of the Dutch upstream investment climate – originate from the same source: the mature state of the industry, resulting in increasing opex, increasing uncertainty about infrastructure conditions, and the increasing need to exploit more tough, tail-end and contingent resources. The involvement of the Dutch government in the upstream natural gas sector has always been limited to the SFP and adjustments of the Mining Act. The new challenges of the upstream industry might ask for another role of the government, with more enforcement, coordination, and targeted stimulation of required activities. This comes down to a paradigm shift, with the awareness that a mature – or declining – industry asks for a re-think of the government's role.

The gas roundabout policy positively contributes to the attractiveness of the Dutch upstream investment climate, but its current form is insufficient to achieve the desired 230 bcm. Additional issues need to be addressed.

6.2 CONTRIBUTION OF THE GAS ROUNDABOUT POLICY ACCORDING TO TCE

This paragraph will examine the contribution of the gas roundabout policy to the attractiveness to the upstream investment climate by applying TCE theory. This theory was extensively explained in section 5.4.1.2. The elementary transaction of this chapter will be the "sales agreement of the produced natural gas, between the upstream producer and the midstream buyer". As indicated in section 5.4.1.2, there are also other transactions involved with upstream investments. Because the gas roundabout policy does not aim to contribute to these transactions – e.g. the establishment of the long-term investment and operations governance JOA and OvS, or the agreement to transport and process natural gas – these issues will not be examined in this chapter, although the TCE theory provides an interesting perspective to these issues in other studies (see Park and Kim, 1997; Sharma, 2007; Hubbard and Weiner, 1991; Finon and Perez, 2008).

In the market structure before the liberalization, the buying party was a vertically integrated company (Gasunie in the Netherlands), which also owned the transmission pipelines (see Correljé et al, 2003; Roggenkamp, 2007). This market structure involved a buyer which also owned specific assets for the transport of natural gas. The interdependency between asset-specific producer and asset-specific vertically integrated transport and sales company is extensively embedded in literature (Hubbard and Weiner, 1991; Correljé and Groenewegen, 2006; Neumann and Hirschhausen, 2006; Spanjer, 2009; Haase, 2008; Correljé and De Jong, 2009). Many scholars have contributed to the understanding about transaction costs involved in these different market structures (pre-liberalization and liberalized gas markets). The scope of this study is different as the gas roundabout policy is assumed to change the governance structure from oil-linked long-term contracts, to a hybrid form of sales were long-term gas is priced on a gas-to-gas basis, and part of the gas is directly sold on the exchange (an assumed 25%, see chapter 2). Figure 36 indicates the contribution of the gas roundabout policy to the governance attributes. This chapter must determine whether this contribution has an effect on the transaction costs, and with that a potential investment hold-up.

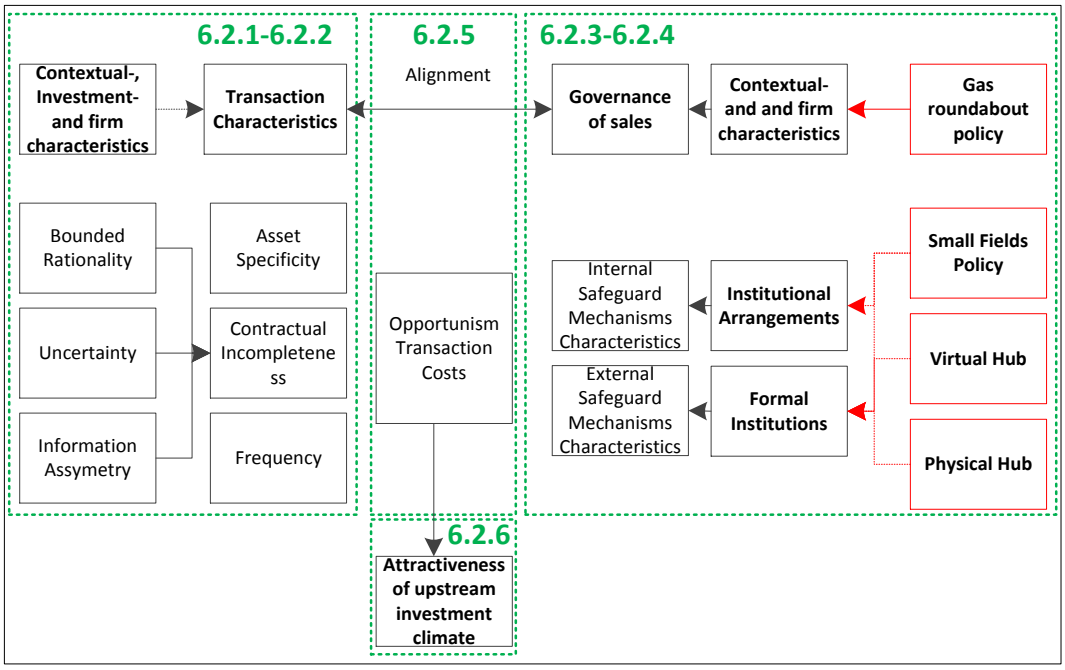


FIGURE 36: TCE DIAGRAM FOR CHAPTER 6.2

Section 6.2.1 and 6.2.2 will elaborate on the transaction attributes, and the theoretical optimal mode of governance according to Joskow (2003), based on these transaction attributes. Section 6.2.3 and 6.2.4 will emphasize on the governance attributes, and will address the contribution of the gas roundabout policy to these attributes. Section 6.2.5 will describe the transaction costs involved in both market situations, section 6.2.6 will conclude.

6.2.1 TRANSACTION ATTRIBUTES

ASSET SPECIFICITY

Production investments and operations are long-lasting as the average production time of a well is 10-15 years in the Netherlands (De Haas, 2008). Production activities involve €15-20 million capex upfront for the well and €25-40 million capex upfront for the field-development (see 6.1.2). Off-shore production activities are more expensive than on-shore production activities.

Production investments involve several asset specificities. First, there is site asset specificity, related to the location of the gas reservoirs, stemming from natural and geological processes. The location of a well and production site is related to the location of a natural gas reservoir, determined by geological conditions. Secondly, there is dedicated asset specificity. The investment and establishment of a well is dedicated to produce a particular amount of natural gas from out a particular reservoir. Third, there is physical asset specificity. Natural gas reservoirs comprise a specific natural gas quality (e.g. the calorific value or water-content) and specific geological conditions (e.g. conventional or tough gas, but also the pressure and depth of a reservoir). These conditions, determined by nature, have an effect on the required assets for exploration and production. Off-shore production assets are on average more expensive than on-shore production assets. This is because off-shore pipelines and platforms are more expensive than on-shore infrastructure and facilities, involved for the field-development. However, both on-shore and off-shore production involve similar specificities of the assets.

These asset specificities account for the selling party (the owner of the natural gas, either EBN or the license holder(s)), and not for the buying party (GasTerra, E.on, Vattenfall etc.). Especially the dedicated asset specificity determines the production profile and subsequent optimal volumes of production and flexibility, which are governed by a sales contract to recover the investment.

UNCERTAINTY

Production and sales activities and investments comprise of both behavioral and environmental uncertainty. Behavioral uncertainty is associated with actor-interaction, and will be described in section 6.2.5 as this is the product of the decided governance arrangement. Involved environmental uncertainties can be of different nature: technical, economical (market) and regulatory uncertainty.

Technical uncertainty

The main technical uncertainties, related to producing and selling natural gas, are short-term operational uncertainty, and long-term infrastructure availability. Operational uncertainty is associated with the production-profile of the natural gas field. The production profile is depending on the pressure of the field, the production-phase of the field, and the availability of operational equipment. The first two factors are determined by the type of field and other natural characteristics, on which the operator has very limited control. Ex ante, the operator cannot completely predict the ex post production level and profile over the life-time of the field. This urges the need for certain flexibility and supply allowances in the sales contracts. The availability of operational equipment can be more influenced by the operator; however some external events (storms, unscheduled maintenance, and explosions) may result in a *force majeure.* This is a situation in which the field cannot produce, also called *failure-to-perform.* A force majeure can be caused by the operator (sub-optimal scheduling of maintenance, erosion of quality) of by external events, urging the need for a proper governance arrangement to decide upon the responsibilities and liabilities of the parties. The second technical uncertainty relates to the availability of infrastructure to tie-in the produced natural gas. When pipelines or platforms – required to connect the produced off-shore natural gas to the market – are decommissioned, the producer has to find other (more expensive) tie-ins. This transport-transaction can also result in investment hold-ups. As mentioned, this research will merely emphasize on the sales-transaction as this is related to the gas roundabout policy. Other research can add to the understanding of investment hold-ups by examining the transport-transaction.

Economical uncertainty

As already introduced in chapter 2, economic uncertainty comes over two axis, price- and volume uncertainty. Price uncertainty for the producer relates to level of certainty concerning the price which is paid for the natural gas to recover the investment. Due to the long lead times, this price uncertainty comprises 10-15 years. In the business-case calculations, there is a floor-price of the natural gas which is required to recover investments. Governance arrangements are set up to mitigate this price uncertainty (see 6.2.3). The price risk is also present for the midstream buyer, as he is also depending on the willingness-to-pay and alternatives of the end-consumer. Volume uncertainty, or security of demand, relates to the risk that there is no proper demand for produced natural gas. Demand from natural gas is affected by the role of natural gas in the energy-mix, energy consumption levels of consumers, the weather, and other factors. For this part of study, the demand is aggregated to the demand level of midstream buyers – either demand for bilateral or exchange. The initial institutional structure of the Dutch natural gas system – the "Gasgebouw" see appendix 2 – was for a large extent designed to mitigate these two uncertainties (see Correljé and Odell, 2000; Correljé et al, 2003 and Roggenkamp, 2007).

Regulatory uncertainty

The last form of uncertainty relates to the institutional context in which sales agreements and upstream investments have to be established. Spanjer (2009) extensively describes regulatory uncertainty. Adjustment of laws and regulations, nationalization of assets or companies, could be the product of regulatory uncertainty. The main regulatory uncertainty within the scope of this chapter is the formal institutions – enabling and constraining the governance arrangements for selling the natural gas: the Gas Act, the Mining Act, and the small-fields policy.

The above mentioned sources of uncertainty were discussed with Mr. Van Mannekes – the secretary general of the Association of Dutch E&P firms (NOGEPA). He states that "Due to the small-fields policy (SFP), the market risk in the Netherlands is relatively low. Regulatory risk and infrastructural uncertainty are the most important categories at the moment." (NOGEPA, 2012a) This also suggests a certain interaction between the uncertainties. As the regulatory SFP impacts the economic uncertainty. The uncertainties cannot be addressed in isolation, and determine investments to a large extent (see Carruth et al, 1998; Fan and Zhu, 2010; Pawlina, 2003 for more on investment under uncertainty).

FREQUENCY

In the old market structure, long-term contracts were set for the depletion time of the field, approximately 15-20 years. Prices and conditions were annually set by GasTerra and not negotiable. An opt-out clause enables producers to switch from buyers. In the new market structure, the frequency of transaction will be higher for both long-term sales (frequent adjustment of price-formula and contractual terms and parameters) and extremely high for exchange transactions (full-time engagement on the wholesale market).

CONCLUSION

The transaction attributes are characterized by a high level of asset specificity for the producing party, who sells the gas to a midstream party which does not have specific assets involved in the transaction. Uncertainty is the most important transaction attribute, segmented in technical, market and regulatory elements. Upstream investments are characterized by a high level of *ex ante* (before the governance arrangement is established) uncertainty, which needs to be mitigated by governance arrangements. Technical uncertainty is expected to increase when more tail-end, tough and contingent resources are produced and sold to the market. *Ex ante* market uncertainty is very high. The frequency of the transaction depends on the mode of governance. The level of *ex post* (after governance arrangement is established) uncertainty does not only depend on the governance arrangement, but also on the context-, investment- and firm characteristics. This will be addressed in section 6.4.

6.2.2 THEORETICAL OPTIMAL MODE OF GOVERNANCE AND EMPIRICAL MODES OF GOVERNANCE

As explained in 5.4.1.2, TCE theory makes predictions about the (theoretically) optimal mode of governance depending on the transaction attributes asset specificity and uncertainty (Joskow, 2003). For transactions characterized by high asset specificity for one party, and high uncertainty, vertical integration is expected to be that mode of governance with the lowest transaction costs (Joskow, 2003):

TABLE 10: OPTIMAL MODES OF GOVERNANCE FOR (JOSKOW (2003))

		Asset specificity		
		Low for both parties	High for both parties	High for only one party
Uncertainty	High	Long-term contract (hybrid) or vertical integration	Vertical integration	Vertical integration
	Low	Spot contracts	Long-term contract (hybrid)	Vertical integration

Although the theoretical optimal mode of governance would suggest that all producing firms would 'sell' their natural gas to their own commercial department – and with that create a vertically integrated structure – empirical evidence of the Dutch natural gas system shows that almost all natural gas (99,3%) is sold to GasTerra, and that only some 0,7% is sold to another party, which can be an own commercial department.

Figure 36 below indicates this, and is segmented in EBN (owner of 40% of the produced natural gas), NAM (a 50-50 joint venture of Shell and ExxonMobil), other large firms, medium firms, and small firms as this will become important distinctions in the subsequent phases of analysis.

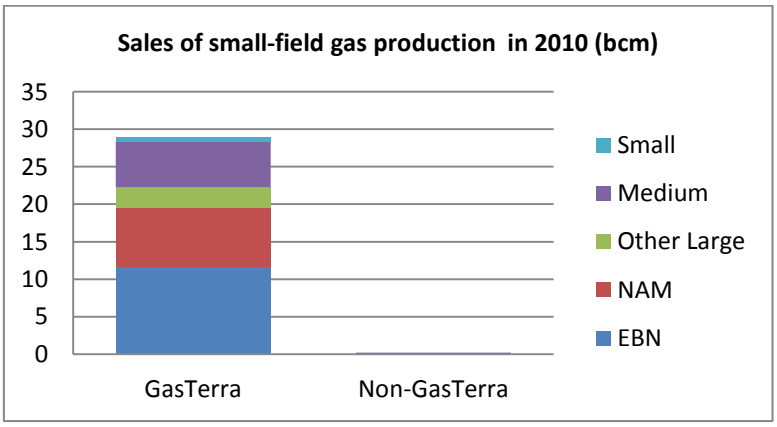


FIGURE 36: DISTRIBUTION OF SALES OF THE SMALL-FIELD GAS (SOURCE: OWN CALCULATIONS BASED ON EBN, 2011:8 AND GASTERRA, 2011:233) ASSUMPTION: ALL NATURAL GAS (100%) IS SOLD BY LONG-TERM CONTRACTS AGAINST NIP (MARKET CONFORM) CONDITIONS WHEN GASTERRA IS THE BUYER.

How can it be explained that almost all natural gas is sold to GasTerra? The remainder of this section will attempt to give some explanations and nuances.

It must be mentioned that the share-holders of GasTerra are Shell (25%), ExxonMobil (25%), the Dutch State (10%) and EBN (40%) (GasTerra, 2011:79). It can therefore be said that the ties of EBN and NAM with GasTerra are more tending towards vertical integration than a pure hybrid mode of governance. Therefore, the empirical distribution of governance modes of the sold natural gas are presented in table 11.

[3] For reasons of data limitations and confidentiality, and for reasons of simplicity it is assumed that the producers of natural gas are 100% owner of the license-holder share. In other words, it is assumed that the only mode of governance for JOA is the single-JOA. Moreover, it is assumed that only the medium firms sell natural gas to non-GasTerra because small firms do not have commercial departments and because NAM and EBN are shareholders of GasTerra.

TABLE 11: DISTRIBUTION OF GOVERNANCE ARRANGEMENT FOR SELLING NATURAL GAS. (SOURCE: GASTERRA: 2011:23 AND ASSUMPTION THAT TOTAL AND SMALL FIRMS SELL TO GASTERRA, AS THESE SMALL FIRMS ARE OFTEN NOT EQUIPPED WITH AN OWN COMMERCIAL DEPARTMENT, AS INDICATED IN OPERATOR INTERVIEWS).

2010 natural gas sales governance (in bcm)	(semi) Vertical Integration	Hybrid (GasTerra)	(non-GasTerra)	Spot contracts
EBN (12)	12 (100% of EBN)	-	-	-
NAM (8)	8 (100%)	-	-	-
Large (non-NAM) (3)	-	3 (100%)	-	-
Medium (<7)	-	6 (97%)	<1 (3%)	-
Small (1)	-	1 (100%)	-	-
Total (~30)	20 (66%)	10 (~33%)	<1 (<1%)	0 (0%)

As the table above shows, the majority of the sales of the natural gas are governed by vertical integration: the most optimal form of governance according to Joskow (2003) to govern particular transaction attributes. Nevertheless, about 33% of the sold natural gas is governed by a hybrid mode of governance. Will these firms suffer higher transaction costs? Are NAM and EBN forwardly integrated to reduce transaction costs? This will be investigated by looking at the associated transaction costs of these different modes of governance in the remainder of this chapter.

6.2.3 GOVERNANCE ATTRIBUTES WITHOUT GAS ROUNDABOUT POLICY

As indicated in figure 36, the gas roundabout policy contributes to the governance attributes of the sales agreements by (i) the direct contribution, originating from continuing the small-fields policy, and (ii) indirectly by changing the market structure into a virtual- and physical hub. To given a substantiated explanation about the contribution of the gas roundabout policy, this chapter will assume that the small fields policy would be abolished without the gas roundabout policy, and that producers of natural gas will sell their gas to midstream buyers by bi-lateral long-term contracts with oil-index.

This chapter will describe the governance attributes of such a situation (the base-case). The next paragraph will substantiate the assumed contribution of the gas roundabout policy to the governance attributes, by describing the contribution of the (i) small fields policy (6.2.4.1) and (ii) the development of the physical and virtual hub (6.2.4.2).

For reasons of confidentiality and data limitations, governance attributes in this base case will be described in general terms, based on studies on long-term bi-lateral oil-indexed contracts by Creti and Villeneuve (2004), Konoplyanik (2010), Stern (2009), Stern and Rogers (2011), IEA (2008) and Frisch (2010). General characteristics of those contracts are already discussed in chapter 2. The dimensions of the governance attributes are derived from Williamson (1991), and comprise internal (general provisions, governance instruments, performance attributes) and external safeguard mechanisms (contract law).

GENERAL PROVISIONS

As described in chapter 2, the general provisions of the assumed market structure without gas roundabout policy is characterized by long-term bi-lateral contracts between the producer and a midstream buyer. The price is determined by a price-formula, of which all indices are related to substitute fuels. Market parties do not have the alternative to sell their natural gas to a liquid, well-developed exchange. The transaction is governed by the contract which can be re-negotiated or adjusted in its pricing formula on regular terms, and take-or-pay and flexibility (ACQ) clauses are included.

GOVERNANCE INSTRUMENTS

Williamson (1991) identifies incentive intensity and administrative controls as the two main governance instruments (also see 4.4.1.2). The incentive intensity within the natural gas contract comes down to the take-or-pay clause and the flexibility clauses (ACQ). These clauses incentivize the producer to deliver an *ex ante* agreed range of natural gas (ACQ +/- X%), or otherwise a penalty for imbalance will be imposed (administrative control within the contract). The take-or-pay clause incentivizes the buyer to actually take an *ex ante* agreed

amount – or at least pay for a certain amount (take-or-pay clause for X% of the contracted volume). Clauses to mitigate a *force majeure* incentivize the producer to ensure that his operational quality is proper, and prevents that a *force majeure* caused by an external event will not result in a penalty.

PERFORMANCE ATTRIBUTES

Adaption to market-prices and circumstances is not only incorporated in the long-term contract by means of the take-or-pay and flexibility clause (mainly aimed at short-term adaptation), but also by the possibility to re-negotiate the price formula, and adjustment of the parameters. The terms and conditions for adjustment and re-negotiation are *ex ante* agreed upon in the contract.

CONTRACT LAW

General formal institutions are the external safeguard mechanism, being the national court to settle disputes. The governance attributes in the *base-case* structure can be characterized as a classical *hybrid* governance structure.

6.2.4 CONTRIBUTION OF THE GAS ROUNDABOUT POLICY TO THE GOVERNANCE ATTRIBUTES

This section will determine the contribution of the gas roundabout policy to the governance attributes, as suggested by figure 36. First, the contribution of the small fields policy will be examined (6.2.4.1). It is assumed that this policy results in a continuation of the off-take guarantee by GasTerra, who remunerates the producer with the annually set *norm purchase price* (NIP) (see Mulder and Zwart, 2006; Roggenkamp, 2007; Correljé et al, 2003). These conditions are in no sense regulated or subsidized, but are merely *market-conform*. Although the precise governance attributes of a NIP-contract are confidential, Roggenkamp (2007) has provided some general non-confidential insight in the conditions of the NIP-contract. Also, an interview with two employees of GasTerra was conducted to verify these characteristics and to generate additional insight in the *added value* GasTerra can offer due to its public task formalized in the Gas Act. Also, operator interviews pointed out the added value of the small-fields policy. It is assumed that the gas roundabout policy will result in a situation that 75% of the produced natural gas is sold to GasTerra under *small-field policy* NIP-conditions or to other buyers against long-term *gas-to-gas* prices (see chapter 2, based on CIEP, 2008).

Secondly, the governance attributes of exchange (classical market) will be described. These precise conditions are also confidential, but can still be described in general terms based on Stern (2009), Stern and Rogers (2011), IEA (2008) and Frisch (2010) (6.2.4.2).

6.2.4.1 CONTRIBUTION OF THE SMALL FIELDS POLICY TO GOVERNANCE ATTRIBUTES

The small-fields policy (SFP) contributes to the external- and internal safeguard mechanisms of selling the natural gas. Because the NIP represents market-conform conditions, the SFP does not contribute to the price level for producers in another way than alternative contracts with other buyers (see Roggenkamp, 2007). Also, there is no reason to assume that the applied price-formula of the NIP differs from other market contracts. The main *added value* of the SFP lies in the off-take guarantee which is offered by GasTerra. Other aspects of the *added value* are related to connecting the produced natural gas to the infrastructure of GTS (see chapter 2), which will not be addressed here as it has no contribution to the governance attributes of selling the natural gas. The arguments behind the SFP and the exact working of the SFP – the pooling-function of the Groningen-field – are described by Roggenkamp (2007), and not relevant to describe the governance attributes of the SFP with regard to selling the natural gas.

The SFP contributes to the governance attributes by replacing the take-or-pay provision by the off-take guarantee. The flexibility clause remains in place, so the producer still has the obligation to produce a certain quantity range. Where the take-or-pay clause was aimed to *mitigate* demand uncertainty, the off-take guarantee completely takes the demand uncertainty away for the producer. The SFP contributes to the performance attributes by *ex ante* setting the NIP, based on market expectations (Roggenkamp, 2007). The producer has no possibilities to negotiate on the level of NIP, but can use the *opt-out* clause to engage with another party when the price-level or conditions are expected to be better with an alternative buyer.

Because the off-take guarantee is set by the Gas Act (art. 54, see Roggenkamp, 2007), the SFP also contributes to the contract law or external safeguard mechanism. The Gas Act ensures that GasTerra will take all produced gas against market-conform conditions. In addition to that, GasTerra is a very reliant partner because the Dutch state is for 50% share holder (10% directly and 40% through EBN). The annual allowed profit of GasTerra is regulated (see Roggenkamp, 2007) at €36 million, this does not ensure conditions which are other – or less commercial – than the markets', but it can be expected that GasTerra's behavior will not be aimed at *making profit whatever it takes*. In an interview with GasTerra it was stated that "GasTerra seeks for solutions to accommodate difficult supplies (e.g. tail-end and tough fields) together with the producer, and seeks for a solutions which is satisfying for both GasTerra and the producer."

The gas roundabout policy contributes to the governance attributes as explained above. For the remainder of this chapter, it will be assumed that 75% of the natural gas is sold to GasTerra – where the producers can benefit from the SFP – or to other buyers in the market structure *gas roundabout* (see chapter 2). As the market structure *gas roundabout* is characterized by gas-to-gas pricing, the market conform NIP of GasTerra will also contain gas-to-gas indexes. Wintershall: "It is expected that the NIP is increasingly TTF based."

6.2.4.2 Contribution of the development of the virtual and physical hub

As explained in chapter 2, it is assumed that the gas roundabout policy will result in the establishment of a physical and virtual hub. This section will describe the governance attributes of selling natural gas to buyers on the exchange, which emerged due to the gas roundabout policy. These governance attributes are similar to those of the classical market, according to Williamson (1991), and explained according to Stern (2009), Stern and Rogers (2011), IEA (2008) and Frisch (2010) as empirical contract-information is not available or confidential.

General provisions

Chapter 2 explained the contribution of a physical and virtual hub. Such a market structure would result in the development of a liquid, well-functioning exchange where gas can be supplied to, and producers would be remunerated by prices which are based on gas-to-gas competition.

Governance instruments

The incentive intensity in a market is higher than in a hybrid mode of governance, or in a vertical integrated structure (Williamson, 1991:280). Producers of natural gas will be incentivized to adjust their production to the demand of natural gas, as this will gain maximum profit. Also, buyers are incentivized to adjust their demand to market conditions. Administrative controls are zero, as the transaction is merely dependent on market conditions. With the *prospect of gains*, producers will be incentivized to produce efficiently.

Performance attributes

Adaption to market-prices and circumstances is maximal as the gas-to-gas price level perfectly represents the value of natural gas in a liquid and deep exchange. Producers and buyers are completely autonomous in adjusting their supply and demand to these conditions.

Contract law

General formal institutions are the external safeguard mechanism, being the national court to settle disputes and the anti-trust authority (NMa in the Netherland) to ensure fair competition.

Conclusion

The governance attributes in the *gas roundabout* structure can be characterized as a classical *market* governance structure when the natural gas is traded on the exchange. Section 6.2.5 will bring some nuance to the *theoretical* market – as described by the former governance attributes – and additional issues which impact the functioning of the *realistic* market. These issues concern long-term investment signals, asset specificity and technical constraints for perfect elasticity of supply and demand, unregarded the liquidity, deepness and transparency of the exchange.

6.2.4.3 CONCLUSION

Without the gas roundabout policy, it is assumed that producers of natural gas can sell their produced natural gas merely by long-term oil-indexed contracts to midstream buyers (base case in the table 12 below). The contribution of the gas roundabout policy results in a situation where the producers have more options for selling their natural gas: (i) to any midstream buyer by long-term contracts with gas-to-gas index, (ii) to GasTerra, against market-conform conditions and SFP advantages, (both i and ii comprise 75%), (iii) directly to the exchange, against gas-to-gas competition (25%). The table below summarizes the contribution of the gas roundabout policy to the governance attributes in terms of strength of the attribute (0 is weak, + is semi-strong and ++ is strong, according to Williamson, 1991).

TABLE 12: GOVERNANCE ATTRIBUTES

			Base case Long-term Oil-linked	Contribution of the gas roundabout policy		
				Long-term Gas-to-gas	GasTerra (SFP) Gas-to-gas	Exchange Gas-to-gas
Internal safeguard mechanisms	Instruments	Incentive intensity	+	+	++ (off-take guarantee)	++
		Administrative controls	+	+	+	0
	Performance attributes	Adaptation (autonomous)	+	+	+	++
		Adaptation (coordinated)	+	+	+	0
	Contract law		+	+	+	++
External safeguard mechanisms	Formal institutions		+ (court)	+ (court)	++ (Gas Act)	+ (NMa)

The difference between the base case and selling the natural gas to any midstream buyer in the *gas roundabout* does not differ in the strength of governance attribute. The main difference is the nature of the price, which will be examined below. The SFP contributes to the incentive intensity for the buyer (GasTerra) to always buy the gas due to the off-take guarantee. The governance attributes of the exchange are fundamentally different compared to the base case.

The contribution of the gas roundabout policy to the existence of the SFP and the development of the exchange is assumed to simplify this part of the study (see chapter 2). PART I has elaborated on the real contribution of the gas roundabout policy to the existence of the SFP. It was concluded that the existence of the SFP is independent from the gas roundabout policy. Also, future research is necessary to substantiate the contribution of the gas roundabout policy to the development of the physical and virtual hub. A second assumption relates to the perfect liquidity of the exchange (TTF – APX ENDEX). The author expects that this contribution would also have been present without gas roundabout policy.

6.2.5 TRANSACTION COSTS

This paragraph will describe the transaction costs associated with the different modes of governance, in terms of (i) opportunism of the buyer (ii) residual price- and volume uncertainty and eventually (iii) investment hold-ups. This can determine the contribution of the gas roundabout policy to the attractiveness of the upstream investment climate, as a more attractive upstream investment climate would be characterized by lower transaction costs compared to the base case without gas roundabout policy. A first section will describe the transaction costs in the base-case market structure without gas roundabout policy (6.2.5.1) and the second and third section will identify the contribution of the gas roundabout policy to the transaction costs – either positive or negative. Section 6.2.5.4 will attempt to explain the empirical modes of governance, as identified in section 6.2.2, and provide additional insight which explains the *transaction* of selling natural gas.

6.2.5.1 TRANSACTION COSTS WITHOUT THE GAS ROUNDABOUT POLICY

Investment hold-ups occur when the transaction costs involved with establishing (ex ante) and running (ex post) the sales contract are high for the owner of specific assets. This can be the result of untamable opportunistic behavior of buyers or unacceptable levels of uncertainty associated with the investment.

Ex ante, the transaction costs of finding a credible buyer, negotiate on contract conditions, and sign the contract is depending on the contextual market elements, and firm-elements. When the market is characterized by a large number of buyers, the producer has a good bargaining position and chance to find a suitable counterpart. In the market structure without gas roundabout policy, there is no transparent hub to easily find a counterpart. In addition to that, when GasTerra does not have an off-take guarantee, the producer faces the theoretical risk of not finding a suitable counterpart at all, resulting in an investment hold-up. However, this situation is not very likely as the Dutch natural gas wholesale market is well developed. Also, the firm-specific elements determine the possibility to sell natural gas to an own commercial department, and with that the associated transaction costs of establishing and running an own commercial department.

Ex post, the transaction costs are low. Re-negotiating the contractual terms and price-index is most certainly no hurdle for investments. The internal and external safeguard mechanisms provide the producer with some certainty about price – by means of the mutually agreed price-formula – and volume – by means of the take-or-pay clauses. Opportunism is mitigated by these instruments. However, there remains a residual uncertainty about volume – the take-or-pay clause does not ensure complete coverage of demand-uncertainty – and external events could result in unforeseen renegotiations or drawbacks of the buyers, in cases of bankruptcy or extreme market conditions. As the possibilities to mitigate these residual risks without the gas roundabout policy are limited – there is no liquid exchange, or derivates market to hedge risks – the transaction costs of selling natural gas are unfavorable to the producer. However, transaction costs are insignificant compared to other drivers for the investment, such as the POS and the involved capex and opex (EBN, 2012b).

6.2.5.2 CONTRIBUTION OF THE GAS ROUNDABOUT POLICY TO THE TRANSACTION COSTS: CONTINUATION OF THE SFP

Due to the small-fields policy – and the derived role and obligation of GasTerra - ex ante transaction costs are lower compared to the base-case market structure because producers always have the option to sell their natural gas to GasTerra, against market-conform conditions. GasTerra's subsequent role as possible *sales-agent of the small-fields* results in very low ex ante transaction costs because the operators do not have to establish an own commercial department, and have the certainty of an *ex ante* contract against market-conform conditions.

Ex post, the transaction costs are also lower compared to the base case scenario, as re-negotiation of the contract is done annually and all producers have comparable and market conform conditions. Moreover, because of GasTerra's public task, potential opportunism is lower compared to alternative market parties as described in 6.2.4.1. These conditions make GasTerra a very attractive, credible and trustworthy buyer of the produced natural gas.

Apart from the low behavioral uncertainty, GasTerra also mitigated the two most crucial environmental uncertainties: price uncertainty – by guaranteeing the *market value principle* of the NIP - and volume uncertainty by means of the off take guarantee. Although GasTerra cannot influence price levels, or mitigate changes in the market, the producer is sure that it will receive prices which are at least market conform.

In addition to that, GasTerra offers the service to produce flat. However this service can also be agreed with other buyers, the costs against which GasTerra facilitates challenging production levels out of tail-end and tough fields are considered to be favorable (GasTerra, 2012). With that, the producers can properly mitigate the technical uncertainties described as important transaction attribute.

6.2.5.3 CONTRIBUTION OF THE GAS ROUNDABOUT POLICY TO THE TRANSACTION COSTS: DEVELOPMENT OF A VIRTUAL AND PHYSICAL HUB

The contribution of the gas roundabout policy to the governance attributes described in 6.2.4.2 have a possible impact on the transaction costs of (i) bi-lateral long-term contracts of the producer with GasTerra and all other buyers, because the pricing mechanism will move from oil-linked to gas-go-gas, and (ii) the development of gas-to-gas competition on the exchange.

BILATERAL LONG-TERM CONTRACTING GOVERNANCE WITH GAS-TO-GAS INDEX

As described in chapter 2, gas-to-gas competition is 1.5 time more volatile than oil-linked prices. Therefore, the producer will be more exposed to price-volatility in long-term contracts with gas-to-gas markers. The ex ante cost of safeguarding this volatility – for example by hedging on the derivatives market – comes at costs. Here, the gas roundabout policy negatively contributes to the attractiveness of the upstream investment climate. However, these transaction costs are insignificant compared to other drivers for the investment decision.

Although the volatility will remain higher, independent on the liquidity of the hubs, a liquid and well-functioning market will result in market-conform price indexes in the long-term contracts. The contribution of the gas roundabout to the governance attributes will therefore not negatively contribute to the associated price- and volume uncertainties, under the condition that the used gas-to-gas indexes are liquid.

EXCHANGE GOVERNANCE

Ex ante, the producer requires a commercial department to physically engage in the spot market, or out-source the commercial activities to a broker. The associated transaction costs are higher compared to the structure where GasTerra acts as sales-agent. With standardized products on the exchange, the ex ante costs of bargaining are very low, as are the behavioral uncertainties from opportunistic behavior. The associated environmental uncertainty related to exchange transactions can be significant. First of all, there is no certainty about price and volume. The producer can mitigate demand uncertainty by relying on the liquidity of the market. The price uncertainty can potentially be hedged on the derivates market, although engaging in the derivates market increases the ex ante transaction costs. Depending on the liquidity and well-functioning of the exchange, the gas roundabout policy positively contributes to the transaction costs compared to the old situation. In addition to that, the producer can make profit by *arbitrage* – meaning that he can adjust his production to the market conditions. However, this *theoretical* possible advantage must be placed in perspective, see next paragraph.

Uncertainty of demand was a very important driver for investment governance. The coordinated approach to *commercialize* the Dutch natural gas was completely aimed at mitigating demand uncertainty (see Correljé and Odell, 2000). Demand uncertainty – or volume uncertainty – were also important arguments for establishing the small fields policy (see Roggenkamp, 2007). The gas roundabout policy positively contributes to demand uncertainty by both the SFP and the development of a liquid hub. As investigated by Mulder and Zwart (2006), the SFP does not negatively contribute to the development of the virtual hub. With that, it can be concluded that the policy is *redundant* in mitigating demand uncertainty.

AN INTEGRATED VIEW: HYBRID MARKETS AND OPPORTUNISM

In the old market structure, the flexibility clauses (take-or-pay and ACQ) were established to protect the producer for operational disruptions (force majeure, failure-to-perform) and the buyer from unforeseen demand flexibility. In the new market structure, an additional dimension can be added, derived from the hybrid market structure with both long-term contracts and an exchange. This dimension is opportunism of the buyer with regard to arbitration on market prices. When the market price is low, the buyer might decide might decide to not take a certain amount of the (higher-priced) contracted gas (the *flexibility* range in the take-or-pay clause), and when the market price is high, the buyer might decide to take an additional amount of (lower priced) take-or-pay gas. This opportunistic behavior, possible at the expense of the producer, is not dealt with in the current market situation. The other way around, the producer can 'use' the ACQ for arbitration at the expense of the buyer in a hybrid market (exchange and bilateral contracting).

This increased potential for opportunistic behavior requires costly safeguarding. When this opportunism occurs, the producer must sell the natural gas to the spot market against sub-optimal conditions, or faces a loss of opportunity costs. The first potential harm of this opportunistic behavior can be mitigated by hedging. When GasTerra is expected to be less opportunistic than other buyers, producers can also mitigate this opportunism by selling their gas to GasTerra.

CONCLUSION

The table below summarizes the contribution of the gas roundabout policy to the attractiveness of the upstream investment climate by comparing the base case (assumed market situation without gas roundabout policy) to the market situation *gas roundabout.* The attractiveness is depending on the (i) transaction costs, and (ii) the possibility to mitigate uncertainties.

TABLE 13: CONTRIBUTION OF THE GAS ROUNDABOUT POLICY

			Base case	**Gas roundabout policy**		
Contracting characteristics		Trade mechanism	Bi-lateral	Bi-lateral	Bi-lateral	Exchange
		Counterpart	Any buyer	GasTerra	Any other	Any buyer
		Contract duration	Long-term	Long-term	Long-term	Short-term
		Pricing	Oil-index	Gas-to-gas	Gas-to-gas	Gas-to-gas
		Distribution	100%	75%		25%
Mode of governance			Hybrid	Hybrid	Hybrid	Market
Transaction costs	Ex ante	Drafting and set-up of contract	Moderate: negotiate about long-term contracts and conditions	Low: standard conditions of NIP	Moderate: negotiate about long-term contracts and conditions	Low: standard products on exchange
		Bargaining on sales agreement	Moderate	Low: standard conditions	Moderate	Low: standard products on exchange
		Engagement in derivates market	No	No	Moderate	High
	Ex post	Monitoring and control/ Settling disputes	Moderate: Safeguarding and monitoring set by contract	No: GasTerra as credible counterpart	Moderate: Safeguarding and monitoring set by contract	No

		Opportunism of buyer	Moderate	No	High: possible arbitration with take-or-pay	No
Contribution to transaction attributes	Asset specificity		High for producer	High for producer	High for producer	High for producer
	Uncertainty (ex post)	Regulatory	No	Moderate: SFP determines conditions	No	No
		Technical	Moderate: arranged by contract	Low: possibility to produce flat	Moderate: arranged by contract	-
		Economic: demand	Moderate: take of pay clause	Low: off-take guarantee	Moderate: take of pay clause	Depends on liquidity
		Economic: price	Moderate: due to oil-link	Low: Guaranteed market-conform, prices are volatile but *smooth* by index, depend in liquidity	Moderate: prices are volatile but *smooth* by index, depend on liquidity	Moderate: High price volatility, need to engage in derivates market, depend on liquidity
	Frequency		Moderate: Contractual determined re-negotiations	Low: Annually pre-determined NIP conditions	Moderate: Contractual determined re-negotiations	High: daily involvement on exchange

6.2.5.4 EXPLAINING EMPIRICAL MODES OF GOVERNANCE

Because it was observed that one third of all companies sell their gas to GasTerra, section 6.2.2 questioned whether these firms would suffer higher transaction costs – because their mode of governance (hybrid) differs from the theoretical optimal mode (vertical integration). As explained by in 6.2.4.1, GasTerra offers market-conform conditions to all producers. This is the result of the external safeguard mechanism (Gas Act art. 54), which obliges GasTerra to provide these conditions combined with the off-take guarantee. Possible transaction costs – associated with selling natural gas to another midstream buyer, see 6.2.5.1 – are all effectively mitigated by GasTerra, as the column *base case* compared with the column *GasTerra* in table 14 illustrates. When firms would decide to vertically integrate with the aim to reduce their transaction costs, they will have to compare the surplus transaction costs with the transaction costs of GasTerra. Illustrative, the table below indicates these transaction costs comparison:

TABLE 14: TRANSACTION COST COMPARISON OF GASTERRA

Transaction costs		GasTerra (hybrid)	Own commercial department (vertical integration)
Ex ante	Drafting and set up contract, bargaining on sales agreement	Standardized conditions and NIP, GasTerra takes away midstream-concerns and need for commercial department.	High transaction costs because own commercial department must be established.
Ex post	Opportunism of counterpart	Very low due to credible character (external safeguard mechanism)	Zero
	Mitigated technical	Moderate: Dependent on liability of force majeure. GasTerra seeks for	Zero

	uncertainty	mutual solution	
	Mitigated price uncertainty	Always market conform prices, depending on performance of GasTerra	Prices dependent on performance of own commercial department
	Mitigated demand uncertainty	Off-take guarantee	Dependent on performance of own commercial department, always residual demand uncertainty

This explains why these firms decide to sell their natural gas to GasTerra, and with that move away from the theoretical optimal mode of governance. Vertical integration would not contribute to a more cost-effective safeguarding of the transaction. In addition to that, GasTerra has the portfolio and experience advantages, resulting in possible more favorable hedging on the exchange.

Also, it was questioned whether NAM and EBN are forwardly integrated (as shareholder of GasTerra) to reduce transaction costs. This question can be partly answered by the TCE theory. The initial structure of the "Gasgebouw" was aimed to reduce demand- and price uncertainty by establishing a set of institutional arrangements, and the vertical integrated Gasunie (Correljé and Odell, 2000; Roggenkamp, 2007). These vertical structures were effective, as it created a market for the Groningen gas (see Correljé and Odell, 2000). Moreover, this structure also proved to be effective to stimulate the development of small fields (Roggenkamp, 2007). The institutional arrangements were, however, not only designed to mitigate opportunistic behavior and contractual incompleteness. As there *were* no credible buyers at the time – because the small role of natural gas in the energy mix – the "Gasgebouw" was created to mitigate demand- and price uncertainty (see Correljé and Odell, 2000; Roggenkamp, 2007 for more on this).

THEORETICAL ADVANTAGES OF EXCHANGE-GOVERNANCE IN PERSPECTIVE

Why isn't it expected that firms will engage more in the exchange governance structure? This question can be answered in two ways. Firstly, selling natural gas in a hybrid mode does not only give these firms long-term certainty about price and demand, it gives them certainty that they will recover their investments. CIEP (2008) argues that spot price information could provide additional guidance for investments, as this economic theory applies to most goods and services. However, the forward curve on traded markets is generally not long enough to fulfill such a role for the significant specific investments (CIEP, 2008:12). On the other hand, using average spot prices in pricing formulas of long-term contracts would largely remove the expected benefit of supplying gas at market-reflective prices, signaling scarcity and abundance though (CIEP, 2008:11).

A second explanation is not related to the long lead time, but to the operations and asset specificity. In the ideal market conditions (see Spanjer, 2008), producers adjust their supply to the demand. In the case of upstream operations, this is however more complex. Because the production facilities are designed for a continuous production (technical constraints), and because the producers want to produce the field as quick as possible (economic constraints), the production level is not determined by the price in the market. In additional to that, tail-end fields need to produce flat, meaning that they desire the situation that all produced gas is always accommodated. Long-term contracts are better suitable to these determining factors than exchange markets.

In interviews with operators it was identified that: "The small-fields policy, and especially GasTerra's role, positively contributed to the attractiveness of the Dutch industry." (Wintershall) Moreover: "Due to the stability and pleasant conditions, GasTerra is an attractive buyer. On the basis of 'the package' of price and conditions we determine our sales strategy. When a liquid market emerges, it gives us more opportunities and less uncertainty about the sales of the natural gas. The presence of GasTerra will remain important for volume risk, but the 'gas roundabout' gives us an option to choose." (i.a. ONE). Wintershall: "New contracts are evaluated on a case-by-case basis and existing contracts have opt-out arrangements and will be re-evaluated. Due to the stability and pleasant conditions, GasTerra often is an attractive buyer. When a liquid market emerges, it gives us more options for our sales."

6.2.6 CONCLUSION

This paragraph substantiated the contribution of the gas roundabout policy to the attractiveness of the upstream investment climate by addressing the sales agreements from out the TCE theory. First of all, it must be stated that transaction costs only determine the attractiveness of an investment to some extent. Especially when compared to other drivers, such as capex, opex and infrastructure-access (see 6.1). Modes of governance for selling natural gas are more aimed to mitigate environmental uncertainty (demand and price uncertainty) than mitigating behavioral uncertainty. This again emphasized the added value of the *pluralistic theory of the firm.* Still, the TCE enabled this research to precisely determine the contribution of the gas roundabout policy to the attractiveness of the Dutch upstream investment climate by examining the sales-transaction.

<u>The contribution of the gas roundabout policies' SFP to the attractiveness of the upstream investment climate is positive</u>

When continuation of the SFP is, as suggested (EL&I, 2011:17), due to the presence of the gas roundabout policy, the gas roundabout policy positively contributes to the transaction costs associated with selling natural gas. As firms for not have to establish an own commercial department, or have to engage in costly bargaining processes, the ex ante transaction costs are lowered by the gas roundabout policies' SFP.

When firms assume that they can generate more value by engaging in the exchange, the additional ex ante transaction costs can be compensated – but the presence of GasTerra makes it not necessary to make these costs.

In addition to that, selling natural gas to GasTerra lowers the possible risk of opportunism, caused by arbitration in the hybrid gas roundabout market structure of buyers, at the expense of producers. This is even more important for accommodating tail-end and tough gas supplies.

GasTerra's market conform conditions and off-take guarantee lower the environmental market uncertainty – the main driver of transaction costs. The off-take guarantee and market-conform price conditions reduce ex post market uncertainty.

<u>The contribution of the gas roundabout policies' hub-development to the attractiveness of the Dutch upstream investment climate is neutral, but redundant</u>

The development of a physical and virtual hub result in additional alternatives for producers to sell their gas. The extent to which the governance attributes actually contribute to reduce transaction costs strongly depends on the liquidity of the exchange (TTF). The higher incentive intensity, and autonomous adaptation, which originates from the presence of the exchange must be placed in the perspective of upstream investments – which have technical and economic constraints others than those of firms in traditional economic books.

The biggest contribution of the gas roundabout policy is associated with the gas-to-gas pricing, both on the exchange and in long-term contracts. De-coupling gas prices from oil will not automatically result in *lower* prices, as chapter 2 pointed out. The shift to gas-to-gas pricing only involves more *volatile* prices. The presence of well-functioning derivates markets is elementary to mitigate this volatility.

Market uncertainties are also mitigated by a liquid, and well-functioning exchange (TTF). In this sense, the gas roundabout policy creates a market structure which is redundant for responding to demand- and price uncertainties. Engaging in the exchange, with low transaction costs, gives produces luxury of choice.

<u>The gas roundabout policy urges the need to re-think the *main button* of policy making to stimulate upstream investments</u>

The main instrument of the Dutch government to stimulate investments in small-fields originally was the SFP. The gas roundabout policy takes over some of the initial advantages of the SFP, as volume and price uncertainty can be mitigated by a well functioning exchange. The added value of GasTerra remains as non-opportunistic sales-agent. Although this positively contributes to the transaction costs, the main function of the

Dutch governments' main instrument can now also be mitigated by the market. With that, an important stimulating instrument has lost its uniqueness.

The Dutch government is therefore suggested to re-think the role of GasTerra, or find other instruments with the same impact as the SFP before the gas roundabout policy (and liberalization). Possibly, GasTerra can mitigate tail-end and tough streams at favorable conditions. However, the question is whether this would be market-conform in the light of European antitrust. When the role of GasTerra - and the SFP - is stripped to a non-opportunistic sales-agent within a liquid market structure, the Dutch government should re-think which *buttons* there are available to stimulate upstream investments. Possibly, the *midstream-buttons* have to make room for additional *upstream-buttons*. By establishing initiatives such as Fallow Acreage and the Marginal Investment Allowance, some first steps are made.

By applying the TCE theory, a structured approach was provided to link sales of natural gas to investment hold-ups. The theory was suitable to explore for the differences between the modes of governance caused by the gas roundabout policy. This chapter also explained why the empirical mode of governance is other than the TCE theory would subscribe to (6.2.5.4). Arguments from the TCE were used for this explanation, indicating the suitability of this theory to address particular issues. This illustrates that the theoretical optimal modes of governance cannot be interpreted *prescriptive.* This is in line with Williamson (1990), who states that the TCE should be used descriptive for static comparative analysis – as was performed in this chapter. By combining TCE with the other elements of the *pluralistic theory of the firm,* a more comprehensive insight can be provided where transaction-costs stand relatively to other drivers for a firm's investment behavior. Chapter 6.4 will explicitly come back to this.

6.3 CONTRIBUTION OF THE GAS ROUNDABOUT POLICY ACCORDING TO THE RBV

This chapter will apply the resource-based view (RBV) theory to determine the contribution of the gas roundabout policy to the attractiveness of the Dutch upstream investment climate. As elaborated upon in the theoretic section about the RBV (4.4.1.3), the resources of firms can explain capabilities and subsequent investment behavior. The first paragraph will describe the resources and capabilities of three different types of firms: large, medium and small oil and gas firms (6.3.1). Below, the difference between the firms is discussed (see box 6). The second paragraph will identify the extent to which these firms can capitalize on their resources and capabilities. This can explain the attractiveness of the Dutch upstream industry for these firms to invest (6.3.2). The last paragraph will elaborate on the contribution of the gas roundabout policy to the attractiveness for firms to invest, according to their resources and capabilities (6.3.3).

BOX 6: DIFFERENT NATURE OF LARGE, MEDIUM, AND SMALL OIL FIRMS

Size and level of presence in the Netherlands

In the Netherlands, three types of operators can be distinguished. First, there are large IOCs (Total) and daughter companies of large IOCs (NAM, a 50/50 joint venture of Shell and ExxonMobil). These large firms are present in the Netherlands since the beginning of exploration and production activities on-shore (NAM) and off-shore (Total). Large firms were responsible for the majority of exploration and production activities of small-fields natural gas. These companies are not only large in the Netherlands, but play a prominent role in the global upstream industry. Until recently, also other large IOCs were active in the Netherlands (ConocoPhilips and BP), but they sold their assets to medium firms. Secondly, there are medium sized oil companies (GdF, Wintershall, Centrica, TAQA and Chevron). These companies play a less prominent role in the global upstream industry compared to the large firms, but are dominant in the regional European upstream industry. Medium sized firms play an important role in the Netherlands as they are engaged in many assets and licenses. Many of these companies are present in the Netherlands for decades. Thirdly, there are small firms (Vermilion, ONE, NPN, Dana, Tullow, etc.). These firms are only present in one of a few countries, and relatively new in the Netherlands. Each of these firms is only engaged in a few licenses.

Area and strategy of operations

Large IOCs operate globally, and own assets on almost all continents. Large IOCs do not have a specific focus area, as Shell for example operates in Russia, Nigeria, the US, Europe and Asia. Large IOCs have the strategic focus on the world's largest, most capital-intensive and most technically-challenging projects. Examples are Shell's GTL-terminal in Quatar and the ambition of arctic has production from Polar Regions. Medium firms operate in one or a few regions. This depends on their focus regions, for example Wintershall and GdF have Europe as their focus regions, and Centrica has Europe and the US as focus regions. These firms have the strategy to diversify their portfolio, but leave the most technically-challenging projects to the large IOCs. Medium firms are often involved in both conventional and tough reservoir production. Small firms operate in one or a few countries. For ONE, the Netherlands is the focus country, but ONE also owns some assets in Gabon. For example other small firms such as Vermilion operate in Australia, Canada, the Netherlands, France and Ireland. Small firms are more likely to be specialized in either conventional projects, or specific projects (e.g. shallow gas), however: "Oranje Nassau also explores opportunities to engage in shallow gas fields. We are always looking for different business-models and opportunities, and are not set to one particular type of projects."

Investment decisions

Investment decisions Investment decisions of large IOCs are based on a portfolio of international projects, which are ranked according to risked-value-to-investment-ration (RVIR)[4] for exploration projects and the net

[4] RVIR = (POSc*NPV-(1-POSc)*DHC)/(POSc*CAPEX+(1-POSc)*DHC. Or: expected amount of discounted dollars retuned on a certain amount of dollars invested, taken into account risks and dry hole costs. POS = Possibility of success. NPV = net

present value (NPV) for production projects. The required return on investments (ROI) for large IOCs is on average between 10-15%. Their risk appetite in their portfolio and available budget for new projects also determines investments. Dutch oil fields therefore compete with oil fields around the world for these investors. Decisions for investments by large IOCs are rather complex, and involve a standardized procedure of toll-gate decisions which can take multiple years. The number and type of projects in which large IOCs can invest is numerous, which also explains their careful and standardized decision-making process. This can also be explained by the ownership of these companies, and the requirements from the shareholders.

Investment decisions of medium firms are determined on the basis on NPV, but more depending on the associated uncertainties, and technically challenges of the project. Operator: "Our board does not primarily look to NPV, but looks to the technical uncertainties and the extent to which the project fits within our capabilities and risk appetite." Decisions are also formalized and need to fit within the corporate decision-making procedure and the corporate strategy. There are many projects, within the area of operations, in which these medium size firms can invest. Small firms have less opportunities and choice-luxury for projects. Investment decisions are made on financial criteria, but also on the appetite for risk and the available budget. Decision-making does not occur in a standardized way. "Authoritative CEO's of private share-holders determine the course of the company, based on the technology-strategy and available capital." Investment decisions of small and medium sized companies are therefore more related to their general resources and strategy than large IOCs, who mainly use financial criteria.

6.3.1 RESOURCES AND CAPABILITIES

According to Penrose (1968, 1971) and Barney (1991, 2001), the resources of a firm can explain the nature and capabilities of a firm. This paragraph will therefore emphasize on the most important resources, and how they differ among the three categories of firms. It will also be determined how these different resources affect the capabilities of the firms. Resources can be subdivided in physical-, human- and organizational resources (Barney, 2001).

6.3.1.1 PHYSICAL RESOURCES AND CAPABILITIES

The three most critical physical resources an oil firm can posses are capital, pipeline- and platform infrastructure and equipment for operations (e.g. transport, maintenance and drilling equipment). These three resources will be dealt with below. It will be described how they differ among firms, and how those differences affect the capabilities of firms.

CAPITAL RESOURCES AND CAPABILITIES

Because exploration and production of natural gas is capital-intensive, the availability of capital and the cost of capital for firms is one of the most important resources.

The availability of capital differs among the different firms. Large firms often finance their own projects (from global oil and gas revenues), medium and small firms finance their projects by their shareholders or loans from investment banks (see De Haas, 2007). The access and availability of capital for large firms is therefore substantial. Exploration budget of Shell exceeds €2 billion in 2011, and total investments in production and manufacturing add up to over €15 billion globally (Shell, 2011). Medium firms like GdF have a regional capital budget for investments in E&P of an estimated €1 billion (GDF, 2011). Small companies such as ONE, NPN or Vermilion are depending on funding from private equity firms or share holders, and have an annual budget for investments in new exploration and production activities of around €50 million euro.

The difference in capital resources has two different implications for the capabilities of firms: the capable number of projects, and the capable size of projects. Large firms have the capital to drill dozens of exploration wells, where small firms only has the capital for one or two wells. Moreover, large firms can engage in very

present value, with discount rate of 10%, taken into account all risks on NPV. CAPEX = capital expenditures. DHC = Dry hole costs (Source: Breunese, 2012).

large and very different projects. In that sense, Dutch prospects compete on a global scale with all other prospects for large firms, where small firms are capable to engage in a smaller range of projects. These possibilities also explain the different criteria for the investment decisions, and areas of activity (see box 6).

These different capabilities have two other important effects. Firstly, the available capital and the subsequent potential number of projects determine the ability to spread risks of exploration within a portfolio. Indicative, the impact of a dry-hole drilling for Shell can be mitigated by selecting a portfolio of dozens exploration drillings, each with another possibility of success (POS), depending on the risk appetite and expected returns. The impact of a dry-hole drilling for small firms, with the resources for 1 or 2 wells annually, cannot be mitigated within a portfolio. The perception towards uncertainty and risks is therefore an important derivative from the capital resources and capabilities.

Another important derivative is the opportunity costs. Opportunity costs relate to the 'opportunity to generate more wealth' when the investment is made somewhere else (e.g. in the UK, Norway or Nigeria), or when the investment is postponed (e.g. to wait for higher gas-prices). The capital capabilities of the large firms give them many opportunities for their investments, many possibilities to postpone investments, and no need or decisiveness to potentially sell their assets. This explains why large firms might 'sit on assets or licenses.' Medium and small firms have both less opportunities for investments are fewer opportunities for postponement of investments; this is disadvantageous for these firms.

INFRASTRUCTURE RESOURCES

Ownership of off-shore infrastructure (pipelines and platforms) is a second important physical resource which differs among firms. As indicated in figure 31, large firms own approximately 33% of the off-shore infrastructure, medium firms own 62% of the off-shore infrastructure and small firms own 5%.

This difference in resources has important implications for the capabilities of firms. When a firm has more ownership of infrastructure, the firm has more negotiating leverage with regard to tie-in conditions and tariffs, and has more decision-making power with regard to decommissioning. Because most firms use infrastructure of other firms, the ownership of infrastructure on which those other firms again depend, creates a mutual dependency. Small firms are almost completely depending on other parties for tie-in, which creates higher uncertainty for these small firms. This uncertainty is not supposed to be present in off-shore transmission infrastructure (e.g. NOGAT, NGT trunk-lines) because EBN has equity in this infrastructure.

EQUIPMENT RESOURCES AND CAPABILITIES

A third important physical resource is the ownership of equipment for transport, maintenance or drilling activities. These resources can either be in-house, or outsourced to contractors. The size of the company, and the subsequent level and frequency of demand for these resources, drives this trade-off. The utilization rate of in-house versus outsourced resources is another important driver. Moreover, some resources are always outsourced, for example drilling rigs. Because of the capital-intensiveness of drilling rigs, large-, medium- and small firms all hire these resources from contractors. The hiring conditions are of course depending on the frequency of the demand. Large firms have a higher and more frequent demand for resources and drilling rigs. Therefore, a large part of the equipment for transport and maintenance is in-house. Also, these large companies are a frequent client of the rig-operators, which creates a mutual dependency. The smaller the firm, the more equipment is out-sourced to contractors, and the lower the intensity of the relation with the rig-contractor.

The difference in equipment resources determines the capabilities of different firms. Important derivatives of these resources are the tariffs, waiting-time and bargaining leverage of the firm for these resources. ONE: "The availability, uncertainty and waiting-time on drilling rigs are an important factor for our operations and investments." Moreover, the willingness to jointly use contractors' resources and services is bigger among smaller firms than among larger firms. This gives those firms the possibility to optimize transport, maintenance and other resource-utilization and with that reduce their opex.

CONCLUSION

The difference in physical resources and capabilities has an impact on the preference for a certain size (capital-intensity) and frequency of investments, the investment decision (ranking, opportunity costs, decisiveness), the attitude towards uncertainty associated with exploration (portfolio benefits), tie-in conditions (influence on tariffs and tie-in conditions, influence on decommissioning, dependency on other firms), and contractors (dependency and uncertainty, negotiating leverage) and the willingness to cooperate and share resources. Paragraph 6.3.2 will identify how these different resources and capabilities have an effect on the attractiveness of the Dutch upstream industry.

6.3.1.2 HUMAN RESOURCES AND CAPABILITIES

Apart from capital resources, which are immobile and heterogeneously distributed among firms, also human resources are an important determinant of firms' behavior. This section will focus on staff at production sites (on-shore) or platforms (off-shore). Staff can be permanently in-house or contracted on a project- or temporary basis. This trade-off is faced by all three companies. It was identified that the larger the firm, the more in-house staffing.

This difference in the type of resource has different implications for the capabilities of firms (see De Haas, 2007). There is no unambiguous scientific evidence that in-house staff is more committed of performs better than hires. The biggest difference between the two modes of staffing is the flexibility and the tariffs. Large firms, involved in multiple projects, have the capability to optimize the utilization rate and flexibility of staff in the overall project-portfolio. Hired staff (for the limited set of projects of the medium and small firms) results in lower flexibility, higher tariffs and often a sub-optimal utilization rate. This results in a higher need for cooperation between small and medium firms for staff-pooling. Moreover, the availability and quality of staff in the Netherlands was identified to be an issue. Large firms can recruit and train in-house staff. By doing so, they have control over the availability and quality of staff. Smaller firms do not have the capability to influence the availability and quality of staff.

6.3.1.3 ORGANIZATIONAL RESOURCES AND CAPABILITIES

Besides operations to explore and produce natural gas, engagement in the upstream industry also requires other activities. These range from internal- and external communication, regulatory- and legal affairs, commercial activities and knowledge development (R&D). This section will emphasize on the organizational resources for commercial activities, and research and development.

COMMERCIAL RESOURCES AND CAPABILITIES

After the production of natural gas, the firm has to sell the natural gas to the market. There are two different organizational modes to sell the natural gas: either a firm can sell the natural gas to the market by its own commercial department, or a firm can sell the natural gas to GasTerra. The commercial department determines this resource. Large and medium firms are often vertically integrated into the midstream sector in order to sell the produced natural gas, and to trade other gas. Examples are the commercial departments of Shell, Centrica Midstream, and Wintershall's Wingaz. These departments are equipped with traders and contract-agents.

The presence of an own commercial department creates the capabilities to generate value midstream, and givens the opportunity to also engage in the derivatives market. Establishing an own commercial department has to fit within the strategy of a company, and requires a certain volume of produced natural gas. This explains why most of the large and medium firms (producing >95% of the natural gas) have their own midstream sales and trading desk. When firms are not vertically integrated, they can sell their gas to GasTerra against standardized conditions and contracts. GasTerra acts as *joint-sales agent* for most of the small firms.

KNOWLEDGE RESOURCES AND CAPABILITIES

Knowledge is an important organizational resource. We distinguish between four types of knowledge resources, which could be sources for four types of capabilities.

1. Knowledge resources resulting in long-term competitive advantage

The presence of a large R&D department, which is aimed at long-term innovative solutions, developing and patenting new technologies, is an important resource for firms. Examples are Shell's gas-to-liquid (GTL) technology and Centrica's self-installing-platform.

This knowledge resource is crucial for developing long-term competitive competences and capabilities for firms. An R&D department can generate long-term value, but also results in higher overhead costs. Depending on the strategy of firms, an R&D department is present or not. The alternative, for firms without an R&D department, is to adopt or buy new technologies from firms which have such departments. In general, the development of competitive, fundamental knowledge mostly takes place at large firms. The competitive capabilities resulting from R&D make it possible for those companies to engage in the world most novel and technologically challenging projects.

2. Knowledge resources resulting in medium-term improvement of technology and operations

A second mode of knowledge relates to less-competitive research to improve operations and technology in the medium-term. This knowledge can be developed in-house, can be bought or applied from other companies, or can be developed by joint-industry programs. Wintershall indicated: "We are involved in a tight-gas project for piloting. We develop this knowledge in-house, in order to explore whether we can use our technology-resources and strategies to diversify our project portfolio and engage in shallow gas exploration and production." Joint-industry research programs result in more joint-knowledge about technologies. An example is the on-going development and application of certain tail-end technologies. Because small and medium firms often to not have their own R&D department, joint-industry programs are very important to them. ONE: "Small firms need to go 'outside' to find knowledge, where larger firms have in-house knowledge." Large firms are less involved in those projects, as they can develop such knowledge in-house.

3. Knowledge resources resulting in short- to medium term improvement of operations

A third mode of knowledge is day-to-day knowledge, resulting in incremental improvement of operations and application of technology. This knowledge is developed 'on-the-job', or 'learning-by-doing.' To improve cost-efficiency of operations, this category of knowledge is very important to all firms. This knowledge can be developed in-house. More projects will result in more possibilities for learning, so this type of operational-knowledge is developed more rapidly and frequently within large firms.

4. Strategic knowledge resources and expertise, shaping the firms' specialties and strategy

A last source of knowledge stems from the strategic knowledge or expertise of a firm. Some firms are dedicated to a limited type of projects, require a specific know-how about associated technology and operations. An example is Cuadrilla, a small British firm specialized in hydraulic fracking. Specific knowledge about this certain technology shapes the strategy of the firm. They build knowledge for their strategy on all 3 above mentioned levels, but then specific for one technology. Such firms select possible projects based on their specific knowledge and willingness to engage in only a specific type of activities.

CONCLUSION

The commercial en knowledge-related resources and capabilities of a firm strongly determine the sales-strategy (willingness to generate value midstream, dependency upon buyer), the type of projects which fits the firms' resources and capabilities (technologically challenging projects, specific type of projects), the willingness to cooperate in joint-industry R&D and the operational performance of a firm.

6.3.2 ATTRACTIVENESS OF THE DUTCH UPSTREAM INDUSTRY

Based on the resources and capabilities of firms, this paragraph will determine how attractive the Dutch upstream industry is to maximally exploit these resources and capabilities.

6.3.2.1 ATTRACTIVENESS FOR LARGE FIRMS

Because of both the capital resources, and the knowledge resources of large firms, the Netherlands is expected to be not very attractive to large firms (also see De Haas, 2007). Because there is a very small group of firms which has comparable resources, large firms can generate more value in technologically-complex, capital-intensive projects (e.g. arctic mining) than in the high-competitive, lower capital-intensive projects in the Netherlands. This perception of firms towards smaller fields is an important derivate of the available capital resources of different firms, and the associated possible range of investments and projects. Based on their international ranking strategy and opportunity costs, more capital-intensive and challenging projects in other parts of the world better march their capabilities. Only when the Dutch prospects can optimize their risk-reward exploration portfolio, these companies have the capability to invest. Otherwise, their capabilities can more efficiently be deployed elsewhere. An exemption can be seen for the NAM, who has a very path-dependent character in the Netherlands due to the Groningen concession. However, new projects are possibly still be ranked within the portfolio of the parent companies Shell and ExxonMobil.

Therefore, large firms can more optimally exploit their resources and capabilities in other parts of the world, where prospects are bigger, projects are more complex and capital-intensive, and more staff is required. The presence of an enormous R&D department is not required for operations in the Netherlands, and will also result in higher unit operating costs (UOC) due to the higher associated overhead costs.

6.3.2.2 ATTRACTIVENESS FOR MEDIUM FIRMS

Medium firms have resources and capabilities which are better aligned with exploration and production activities in the Netherlands. Medium firms are equipped with sufficient capital resources and capabilities to invest in multiple projects, resulting in portfolio-benefits for exploration. Because the Netherlands is not highly capital-intensive, it is an interesting acreage for their portfolio with regard to the size of the projects. Medium firms operate in a limited number of regions, which lowers their opportunity costs. Also their ownership of infrastructure reduces infrastructural uncertainty off-shore. The availability of an own commercial department, and the option to sell their gas to GasTerra gives medium firms the possibility to choose what best suits their resources and capabilities.

The unit operating costs (UOC) of small firms are the lowest. This can be explained because their knowledge resources focus merely on medium- and short term improvement of technology and resources. Medium firms have an in-house R&D department for piloting and development of new technologies, but relatively not as extensive as the large firms. Because part of the staff and equipment are in-house, flexibility and utilization of these resources can be arranged in-house. As these firms are involved in multiple projects, their bargaining leverage against contractors is substantially higher compared to smaller firms. Having some possibilities to recruit and train staff, medium firms have some influence on the availability and quality. The potential upside for lowering the UOC is estimated at 20% for these medium firms, when engaging is more efficient resource-pooling and cooperation with smaller firms. Therefore, engaging in Dutch exploration and production activities matches the resources and capabilities of medium firms. Wintershall: “We see sufficient possibilities for future investments in the North Sea and the Netherlands.”

6.3.2.3 ATTRACTIVENESS FOR SMALL FIRMS

Because of their limited capital resources, the Netherlands is very attractive for small firms. The opportunities abroad, where the required capex is often higher, result in very low opportunity costs for the small firms. Also the size of the projects fit the resources and capabilities of small firms. However, the impact of a dry-hole exploration drilling is substantial. Because small firms do not have ownership in infrastructure, high uncertainty

about tie-in conditions, decommissioning and tariffs make the Netherlands less attractive for small off-shore firms. Also their dependency and weak bargaining position against contractors might be a hurdle for these small firms to exploit their resources and capabilities. The currently limited level of cooperation, resource-pooling and the low insight about resource availability makes the Netherlands no specific attractive place for small firms to invest. This would give small firms the possibility to optimize transport, maintenance and other resource-utilization and with that reduce their relatively high UOC. Because small firms depend on hired staff, they do not have a strong influence on the availability and quality of staff.

As most small firms do not have their own in-house R&D department, they are dependent on joint-industry research and development to improve operations on the short to medium term. However, these small firms do not have large possibilities for 'learning by doing' as they are involved in only a limited number of projects. Operator interviews indicated that there is a big possibility to also develop these knowledge resources and capabilities jointly with other firms. When certain operational criteria are measured or benchmarked (e.g. utilization rate of staff, energy-usage for production) among a large set of small firms, these firms can share experience and knowledge. Because the small firms do not have experience or resources to develop such programs, it was suggested to develop such a program together with EBN. Learning-by-doing from each can, together with resource-sharing and – pooling, reduce the opex of a small firm with 25%. The advantage of GasTerra's role as joint-sales agent is that the small firms do not have to invest in an own commercial department, lowering their overhead costs. The disadvantage is that the firms are very dependent on GasTerra's conditions because there is no alternative. The attractiveness of commercializing the produced natural gas is an important factor for the attractiveness of an industry. In the current situation, GasTerra is a credible party which buys all the gas from small producers, and remunerates them with favorable conditions. Moreover, also medium and large firms often sell their natural gas to GasTerra, because: "GasTerra's conditions and prices are often better than we could realize with our own sales agencies. This is caused by their portfolio-advantage. Although the corporate policy is to sell the natural gas by our own commercial department, the Dutch situation is very in favor of GasTerra." So, as long as the firms generate more value by selling their natural gas to GasTerra, they will not capitalize on their own sales agencies. This identifies a possible treat for GasTerra: when medium and large firms have bigger opportunities for value-creation by selling their gas to the market by their own sales agents, GasTerra may lose its portfolio-advantage. This will result in less-favorable conditions for the small producers which depend on GasTerra's conditions. This could be a 'slumbering' negative effect of the new market context for the small firms. Currently, the role of GasTerra makes the Netherlands very attractive for small firms, from their commercial resources and capabilities point of view.

Therefore, the Dutch upstream industry is moderately attractive to small firms. Their resources and capabilities can be more optimally be deployed in a situation with less uncertainty about e.g. infrastructure, equipment and staff and resource-pooling and joint-knowledge building on the short, operational level could substantially reduce their – currently relatively high – UOC.

6.3.2.4 Presence of different firms in Dutch upstream industry

How important are the different firms for realizing the policy objective? The section below briefly addresses the relative contribution of large, medium and small firms over the period 2004-2010, based on NLOG-data.

First, the number of operating firms tripled from 6 in 2004 to 17 in 2010. In 2004 the majority (92%) of the exploration licenses was operated by large and medium oil companies (e.g. NAM, Wintershall, Chevron). In 2010, all large oil companies gave up their exploration efforts (from 34% in 2004 to 0% in 2010), which was taken over by smaller oil companies (e.g. ONE, Dana; totally from 8% to 51%). So, this set of new, small companies both applied for new licenses (green-field projects) and take over existing licenses from oil majors (brown-field projects).

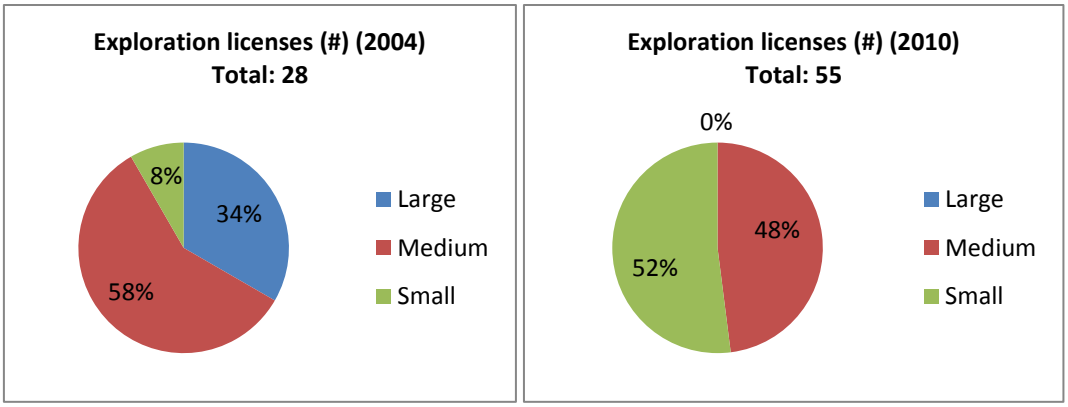


FIGURE 37: SHIFT IN EXPLORATION LICENSES. SOURCE: OWN COMPOSITION, (SOURCE: NLOG, 2012)

The total amount of production decreased over the period 2004-2010. Production from the small companies doubled, production from medium companies increased from 27% in 2004 to 36%, and the production by the large companies decreased.

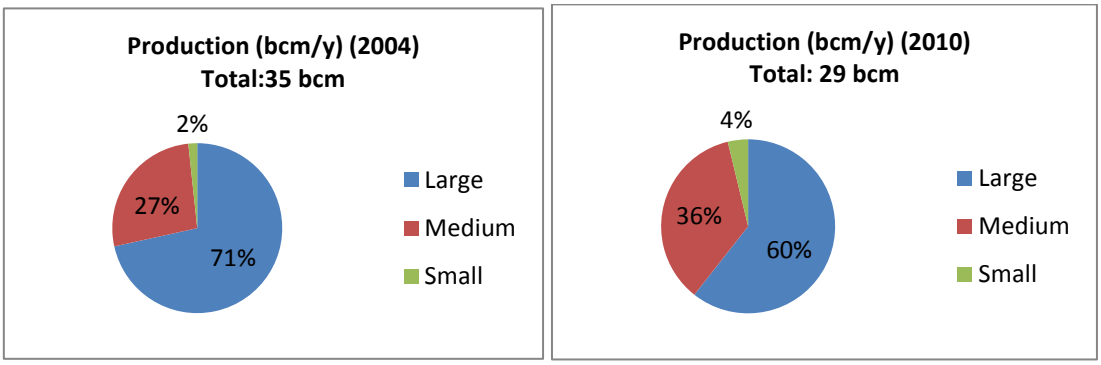


FIGURE 38: PRODUCTION LICENSES (SOURCE: NLOG, 2012)

This is caused by the transfer of production assets and licenses by the large companies to smaller companies, as is shown in the figure38 above. Although the market size decreased, there was an increase in market concentration as the number of companies operating a production license increased from 8 in 2004, to 15 in 2010. Also the distribution of market shared between the large, medium and small companies made a shift, as is shown by the figure above. Given the exploration shift, this shift in production is expected to continue.

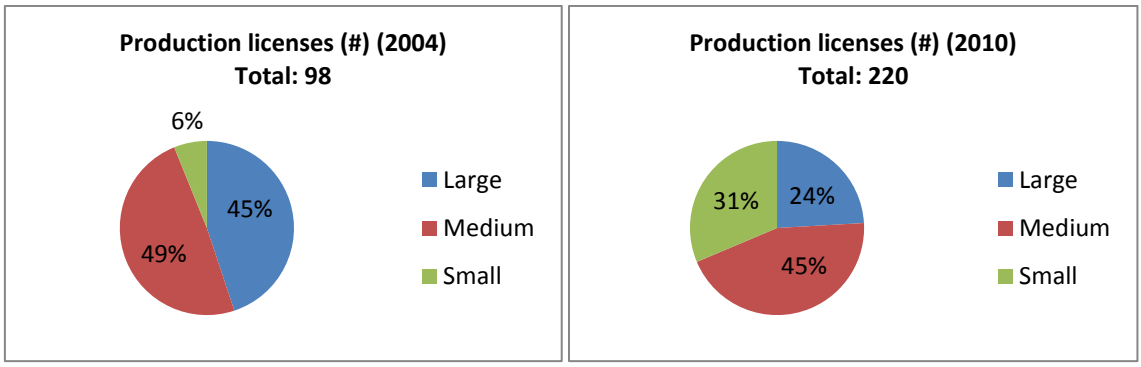


FIGURE 39: PRODUCTION LICENSES (SOURCE: NLOG, 2012)

Small- and medium firms are accountable for most of the exploration and production liceness. Therefore, the attractiveness of the upstream investment climate should be mostly linked to their *relative* attractiveness. Ideally, policy should be aimed to enable the majority of the actor field to maximize their resources. In addition to that, the maturing state of the Dutch industry can also explain this movement of operator landscape.

6.3.2.5 CONCLUSION

The previous paragraphs identified the resources and capabilities of three different categories of firms (6.3.1). Also, it was determined how attractive the Dutch upstream industry is to invest for these firms, based on their resources and capabilities (6.3.2). It was concluded that the Dutch upstream industry is not very attractive for large firms, attractive for medium firms, and moderately attractive for small firms. Small and medium firms have become increasingly important over the recent years (6.3.2.4). The following elements are the drivers for the moderate attractiveness for small firms:

- High impact of dry-hole drilling: small firms do not have portfolio-resources to compensate a dry-hole drilling;
- Importance of joint R&D programs and knowledge building: small firms (and to a less extent medium firms) do not have 'in-house' capabilities and resources to develop technologies or increase *operational excellence*. Small firms have low information-availability and depend on external sources.
- Weak bargaining position of small firms towards contractors;
- Low level of cooperation and joint-resource pooling: resulting on a high UOC for small firms;
- High uncertainty about infrastructure for small firms;

6.3.3 CONTRIBUTION OF THE GAS ROUNDABOUT POLICY

As indicated in paragraph 5.5.1 (see figure 14), the gas roundabout policy contributes to firm-elements by means of the innovation contracts. Innovation contracts (IC) will contribute to the knowledge resources of firms. As described in section 6.3.1.3, IC will mainly contribute to *medium term knowledge resulting is more efficient technology and operations.* This will especially benefit medium- and small sized firms, as they have a stronger tendency – and need – to collaborate on joint knowledge-building. It is hard to determine what the contribution of IC will be in terms of additional bcm's. Looking at foreign R&D programs, comparable amounts are jointly spent to similar programs (e.g. OG21, 2010). This indicates that the input of the gas roundabout policy is at least sufficient to be comparably attractive as Norway in terms of the possibility to jointly deploy research and innovation. In absolute terms, the annual budget of the IC *upstream gas* comprises €20 million (EL&I, 2012:90). Compared to the capital-intensity of upstream investments (€20 million for one exploration drilling), it is assumed that the contribution of the IC is limited.

In addition to that, continuing the small-fields policy – with GasTerra's role as *joint sales-agent* – also contributes to the attractiveness of the Dutch upstream investments clime, as small-firms are not obliged to establish an own commercial department. This aspect is already extensively addressed in 6.2.

6.3.4 CONCLUSION

The gas roundabout policy contributes to the attractiveness of the Dutch upstream investment climate, as small- and medium firms can better capitalize on some of their resources (e.g. R&D) and capabilities (e.g. commercial departments). However, the resources and capabilities of especially small firms result in several issues (see 6.3.2.5), which are not mitigated by the gas roundabout policy. Because these firms have become more important in the Netherlands (see 6.3.2.4), it is elementary that there is an attractive investment climate for these firms to invest and operate. In addition to that, the capital resources of the small firms cannot be influenced by the government. A possible solution would be to increase the number of firms in the Netherlands, as this would result in an increased *cumulative* resource for activities and investments.

The resources and capabilities of large firms explained why these firms withdrawn from the Netherlands, and why there are other regions outside the Netherland which are more attractive for them. For medium firms, the Netherlands remains an attractive acreage. The identified shift in the operator landscape, and the subsequent shift in problem- and solution importance, should be taken into account for proper policy making and analysis. This insight was created by applying the RBV theory.

6.4 CONTRIBUTION OF THE GAS ROUNDABOUT POLICY: AN INTEGRATED VIEW

The previous chapters have examined the contribution of the gas roundabout policy to the attractiveness of the upstream investment climate from three different perspectives. It was explored which elements determine upstream investments, and how the gas roundabout policy facilitates these investments. The *holistic methodology* of Porter identified that the structures of the industry and market determine firms' investment behavior. Adjusting these structures (due to fallow acreage and the fiscal measure, but also by adjusting the physical and economical market structure) contributes to the behavior of firms – in the sense that their perception towards *attractiveness* can be increased or decreased. This view was complemented by the analyses from the *individualistic methodologies* (TCE and RBV). It was indicated that contributing to *governance arrangements* or *resources and capabilities* can also positively contribute to the attractiveness of upstream investment. Firm's behavior – e.g. their perception to mitigating market uncertainties, or dealing with infrastructure decommissioning – shapes the structures of the industry. The two methodologies therefore clearly explain the *interactionistic* nature of individual firms, and the industry as a whole. This has not only provided a rich insight in the contribution of the gas roundabout policy, but also identified important issues which could be addressed to improve upstream natural gas policy. This paragraph will emphasize on the additional insight created by applying the *pluralistic theory of the firm*, compared to analyzing the issue only by three separate theories. As indicated in 5.6, this will result in more attention for the methodological interactionistic nature of the research domain. This "integrated view" provides additional insight as it brings together insights from the three theories, and compensates shortcomings of single theories.

INTEGRATING FIRM- AND INVESTMENT CHARACTERISTICS

Firm specific resources determine the *relative* perception of the five forces – and with that the relative attractiveness. Entry-barriers such as capital-constraints, size-requirements and exposure to uncertainty differ among firms. Also the relative power of suppliers and buyers are different. In addition to that, the maturing phase of the industry – determined by natural contextual elements in the framework – also determines the five forces. This influences the potential of different firms to capitalize on their resources and capabilities. The resources and capabilities different firms bring to an industry – and their subsequent behavior –also determines the relative attractiveness of the industry for other firms to invest, or for present firms to increase their activities. When firms are inclined to cooperate, necessary to capitalize on their resources, they jointly change e.g. the power of suppliers, or entry barriers related to high opex stemming from sub-optimal resource utilization. Firm characteristics (e.g. low overhead of small firms resulting in a potential low opex) results in a different perception to the forces (e.g. economic barrier). This explains that different firms can have a different perception to engaging in e.g. tail-end projects. Moreover, as the opportunity costs for large firms are higher, these firms are more inclined to *sit on assets.*

In addition to that, two examples identified that only applying the methodological holistic approach of Porter would result in an incomplete picture. Firstly, 6.1.1.1 indicated that due to the nature of upstream investments and activities, producers of natural gas often co-benefit of other firms' successful activities – in opposite to Porter's theory. When the total amount of produced natural gas increases, the marginal costs of transportation and processing decreases for all firms. Also, when another firm successfully explores for prospects, or brings new reserves into production, the decommissioning of off-shore infrastructure will be extended. This has a positive effect on the 'window of opportunity' for all firms. Secondly, the main elements of Porter to address the power of buyers are less relevant for upstream activities (see 6.1.4.2). Price-sensitivity and the bargaining position determine to a less extent the power of buyers, compared to uncertainty about price and demand. By applying TCE, a more rich and nuanced picture regarding the power of buyers was provided.

Therefore, it is elementary to take into account both the landscape of firms, their interaction, the specific nature of upstream investments and the associated governance arrangements when examining the five forces. This helps in explaining the attractiveness of e.g. tail-end engagements, and helps to identify different behavior

of firms in terms of their activity level – whether they can afford to *sit on assets* or not, etc. Policy makers should be aware of these elements for policy making aimed at facilitating investments.

INTEGRATING FIRM- AND CONTRACTUAL CHARACTERISTICS

The presence of certain resources (e.g. a commercial department, capital-resources) determines the decision for a certain mode of governance to safeguard the transaction, complementary to the transaction attributes. When a firm has to decide upon a mode of governance for requesting and operating a license, either single or in a joint-venture, it is constraint by its resources. The resources of the firm might drive the firm to a governance structure where it can *spread exposure to uncertainty* (take limited equity in multiple projects, instead of full equity in one project). In addition to that, the presence of certain modes of governance – such as GasTerra's off-take guarantee – also shapes the behavior of firms. The presence of GasTerra enables the firm to govern the sales of natural gas *without* the establishment of an own commercial department. This not only lowers transaction costs, it also properly safeguards environmental uncertainties. This insight broadens the TCE view on sales agreements.

INTEGRATING INVESTMENT- AND CONTRACTUAL CHARACTERISTICS

Investment characteristics (uncertainty, asset specificity, capital-intensity, operational flexibility, etc.) determine the optimal mode of governance, as was identified by applying the TCE theory. These modes of governance do not only safeguard the individual transaction, but also shape the structures of the industry. The institutional arrangements determine the *ex post* forces, such as entry-barriers (joint-ventures for mitigating uncertainty), power of buyers (mitigate price uncertainty), and power of suppliers (joint bargaining agreement) – and with that the attractiveness. Firms will be *ex ante* attracted to the Dutch upstream industry when there is the prospect of *ex post* mitigation of uncertainties – as the institutional structures characterizes the market by for example the small-fields policy. This illustrates how the *pluralistic theory of the firm* adds to the limitations of Porter's theory – resulting in additional insights and nuances.

The mode of governance – classical market (exchange), hybrid (long-term bilateral contracts), vertical integration (sales to own commercial department) – determines the actual economical uncertainty as these governance arrangements are aimed to mitigate this uncertainty. As indicated by the *methodological interactionistic framework*, the characteristics of the transaction-attributes are also depending on the contextual-, investment- and firm characteristics. The presence of a liquid exchange lowers economical uncertainty; as such a market context would involve low demand and price uncertainty. Also, the regulatory context for off-shore infrastructure determines the infrastructural uncertainty (the effects of *external variables* on institutional arrangements is described in Haase, 2008; Correljé and De Vries, 2008; Groenewegen and Kunneke, 2005 and Kunneke, 2008). In additional to that, the investment characteristics also determine the transaction attributes, as for example the size and type of field (tough or conventional, on-shore or off-shore, small marginal or large) determine the level of asset specificity and uncertainty. Also, the production-phase of the field (plateau or tail-end) has an impact on the technical uncertainty.

For achieving the policy objective to produce 30 bcm from small fields in 2030, there is a need for tail-end production, tough reservoir gasses and unlocking contingent (marginal) resources (EBN, 2009). These activities involve higher asset specificities and uncertainties compared to the former investment characteristics – conventional fields. The policy objective therefore urges the need for proper governance of these specific and uncertain investments, operations and sales. Therefore, selecting the optimal mode of governance – and policy making – is not only depending on static characteristics of behavior and transaction attributes, but also on dynamic actor behavior and changes in the context-, investment-, and firms' characteristics.

All these interactions do not make policy making easy, but attempting to understand these interactions can surely result in an identification of the possible role of policy. Box 7 concludes this integrated view by elaborating on insight created by applying the *pluralistic theory of the firm* related to the role of the oil-price.

BOX 6: EXAMPLE OF METHODOLOGICAL INTERACTIONISTIC INSIGHT: ROLE OF OIL-PRICE

There is an interaction with this changing governance attribute (pricing mechanism) and the power of suppliers. The costs of drilling rigs are strongly linked to the oil-price. When the oil-price is high, the tariffs for drilling rigs and other resources are increasing as the global demand for these resources increases (EBN, 2012:39). A high oil price during drilling can often be partly compensated when by revenues which are linked to the oil-price. When the gas prices are linked to the oil prices, firms will be compensated for surplus rig-tariffs – due to a high oil price – by higher natural gas revenues. Future research is needed to investigate this possible effect of the movement towards gas-to-gas pricing.

Also, there is a correlation between the oil-price (correlation factor 0.86) and exploration activities. High oil prices had therefore a positive impact on the total market-size of exploration activities in the Netherlands, in terms of licenses and total licensed acreage (EBN, 2012:29). When the natural gas price is decouples from the oil-price, it is questionable whether this correlation factor will remain. This strongly depends on the correlation between the gas-to-gas prices and the oil price. Future research is required to examine this effect.

6.5 CONCLUSION

The research question 'What is the contribution of the gas roundabout policy to facilitating upstream investments?' can be answered. The conclusions from 6.1-6.4 can be generalized to give a comprehensive answer to this question, enabled by applying the pluralistic theory of the firm.

Contribution of the gas roundabout policy

The gas roundabout policy positively contributes to the attractiveness of the Dutch upstream investment climate, as the instruments of the policy – aimed to deliver a direct contribution (see 2.4) – have the potential to actively facilitate 121 bcm of production from small fields for the period 2010-2030, under the condition that these instruments are deployed effective.

Adjusting the Mining Act and the Fallow Acreage covenant have the potential to deliver a positive contribution to the available plays for exploration and production. Benchmarked with the UK fallow initiative, a successful deployment of these policy instruments has the potential to result in significant additional exploration and production investments and activities of around 96 bcm. The marginal investment allowance is expected to deliver a substantial contribution to the attractiveness of the Dutch upstream industry and potentially results in 25 bcm of additional off-shore production.

Continuation of the small-fields policy (SFP) positively contributes to the transaction costs associated with selling natural gas. GasTerra's market conform conditions and off-take guarantee lower the environmental market uncertainty – the main driver of transaction costs – and the potential *power of buyers* to capture producers rents. The off-take guarantee and market-conform price conditions reduce *ex post* market uncertainty, by *ex ante* governance. In addition to that, selling natural gas to GasTerra lowers the possible risk of opportunism, caused by arbitration in the hybrid gas roundabout market structure of buyers, at the expense of producers. This is even more important for accommodating tail-end and tough gas supplies – requiring a *flat* production. Continuing the SFP therefore contributes the attractiveness of the Dutch upstream investment climate. As no existing studies calculate the additional annual production due to the small-fields policy (e.g. Mulder and Zwart, 2006 is limited to consumer surplus and social-welfare effect), additional research is recommended to investigate the costs-and-benefits of the small-fields policy, when producers can also supply their natural gas to a liquid exchange. Current research have indicated that the small-fields policy is been "very effective" to stimulate small fields production (EZ, 2006; Mulder and Zwart, 2006; PRC, 2007). It can therefore only be concluded that *not continuing* the small-fields policy *could* have a very negative effect on the attractiveness of the Dutch upstream investment climate. This would reduce the BAU-area in figure 2.

The gas roundabout policies' innovation contracts contribute to the attractiveness of the Dutch upstream investment climate, as small- and medium firms can better capitalize on their resources and capabilities. Their

limited resources (e.g. R&D) and capabilities (e.g. sales department) is properly mitigated by the policy, making the Netherlands an attractive country for their operations. Because of the limited budget of the innovation contracts, it is hard to quantify the additional production due to these efforts. More research is required to determine the effects of increasing R&D to production and activity levels.

With regard to the indirect contribution of the gas roundabout policy (see 2.4), it can be concluded that the development of a physical and virtual hub result in additional alternatives for producers to sell their gas. The extent to which the governance attributes actually contribute to reduce transaction costs strongly depends on the liquidity of the exchange (TTF). The higher incentive intensity, and autonomous adaptation, which originates from the presence of the exchange must be placed in the perspective of upstream investments – which have technical and economic constraints others than those of firms in traditional economic books (and reports like Mulder and Zwart, 2006).

The biggest indirect contribution of the gas roundabout policy to the market structure is associated with the development of gas-to-gas pricing, both on the exchange and in long-term contracts. De-coupling gas prices from oil will not automatically result in *lower* prices, as chapter 2 pointed out. The shift to gas-to-gas pricing only involves more *volatile* prices. The presence of well-functioning derivates markets is elementary to mitigate this volatility. Market uncertainties can also be mitigated by a liquid and well-functioning exchange (TTF). In this sense, the gas roundabout policy creates a market structure which is *redundant* for responding to demand- and price uncertainties. Engaging in the exchange, with low transaction costs, gives producers luxury of choice – but will not especially result in a more attractive investment climate. More insight can be provided by further research, as it must be determined to which extent a liquid and well-functioning market can take over *all* added-values of the SFP, taking such an analysis further than focusing on classical economic parameters.

<u>Contribution of the gas roundabout policy in the light of the policy objective</u>

Although the gas roundabout policy contributes to the attractiveness of the Dutch upstream investment climate, figure 40 below indicates that it is not sufficient to facilitate the *required* level of investments. A total amount of 230 bcm must be actively facilitated to meet the policy objective, and – as stated above – the current gas roundabout policy *maximally* stimulates investments which could result in additional production of 121 bcm natural gas, under the assumption that all policy instruments are deployed optimally[5].

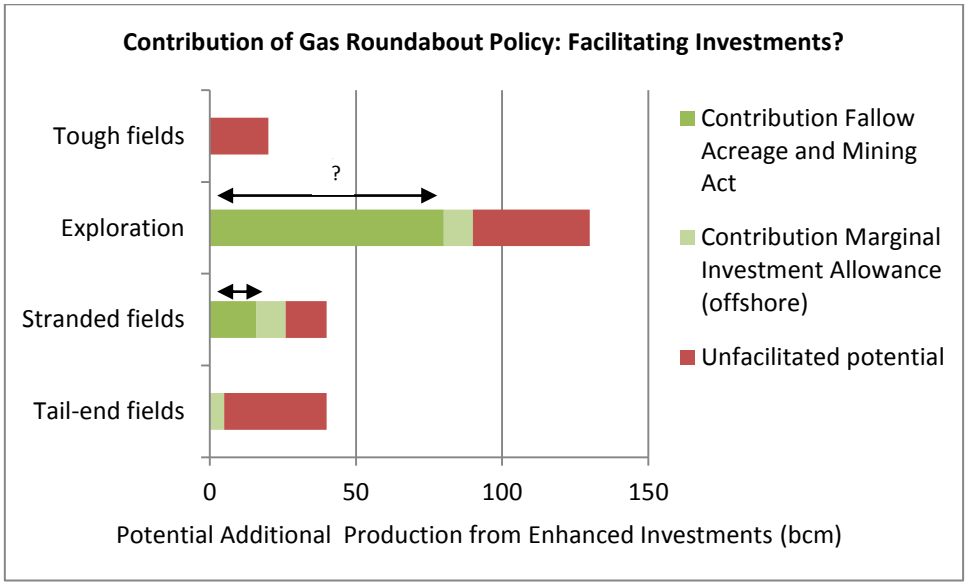


FIGURE 40: CONTRIBUTION OF GAS ROUNDABOUT POLICY TO FACILITATING INVESTMENTS (SOURCE: TOTAL POTENTIAL: EZ, 2012:23 AND EBN, 2010:21; CONTRIBUTION POLICY: THIS THESIS)

[5] Figure 40 already included a comparable fallow acreage-regime as in the UK, so this contribution might be even lower.

The remaining 109 bcm (red-marked "un-facilitated potential" in figure 40) can be valorized by market parties, facilitated by an *active* policy when the Dutch government investigates additional measures to mitigate the residual and unaddressed investment hurdles.

Main challenges for the future

Apart from examining the contribution of the gas roundabout policy, the *pluralistic theory of the firm* also identified residual- and unaddressed hurdles for investments or operations, resulting in a sub-optimal attractiveness of the upstream industry to realize the policy objective to produce 30 bcm from small fields in 2030. These form the main challenges for future policy to address.

Sub-optimal exploration activities

Firstly, the actual available number of plays for exploration is limited compared to the potential market size. This is caused because many of the prospects are on acreage were natural gas is produced, and the producer does not engage in exploration activities.

Secondly, the current Fallow Acreage covenant was identified to be sub-optimal and leaves room for improvement to mitigate opportunism of parent licensees and increase the *prospects of gain* of fallow acreage. Given the benchmarked potential, the sense of urgency needs no further substantiation. Lessons can be learned from the UK-example.

Sub-optimal production activities

The available plays for production investment is limited because some license-holders are *sitting on assets* (brown-field projects) or licenses (green-field projects). Without stimulating the current license holders to improve their level of activity (e.g. oblige them to apply tail-end technologies), or stimulate them to sell their assets, or return their licenses (e.g. by enforce fallow acreage), the potential upside for tail-end production or contingent resource production will be under valorized (see figure 40). In addition to that, it hampers other – more cost-effective or willing – firms to unlock contingent resources. This not only hurts to these firms and the government, but is also at the expense of surrounding producers as sub-optimal production increases costs of infrastructure – and with that the *shadow of decommissioning.*

Increasing opex, inherited to the mature industry-phase

Due to the increasing resource prices, costs of infrastructure, and the increasing number of fields in (more expensive) tail-end phase or of tough nature, the opex of small-fields production increased largely over the recent years. Although it are market parties who have to take actions to reduce costs, the government can play a stimulating role. High opex might result in premature decommissioning of production sites – under-valorizing the tail-end upside – or new investments which not meet the investment criteria, with stranded fields as the result.

Regulatory burdens and public resistance

On-shore permitting procedures involve multiple agencies and procedures, resulting in regulatory burdens. In addition to that, the need for more on-shore (especially tough) projects is associated with public resistance which could hamper or delay projects. The new SG of NOGEPA perceives this as the most important threat for the attractiveness of the Dutch upstream investment climate.

Shadow of decommissioning off-shore infrastructure

The shadow of decommissioning complicates future off-shore activities, adding to uncertainty largely. It increases the power of suppliers – who can charge excessive tariffs or remove cost-effective tie-in conditions of both producing fields and prospects.

New operator landscape requiring adjustments of the playing field

The new operator landscape (especially small firms) face high opex because they do not have the capabilities (physical, organizational and human) to fully capitalize on their resources. This originates from different

sources. Firstly, the lack of possibilities to develop short- to medium term improvements of operations, caused by limited possibilities for *learning-by-doing* and information shortages on both operational performance (application of technologies, performance benchmarks) and long-term possibilities for new activities (limited exploration data, overview of potential plays). Secondly, compared to large firms their size is sub-optimal to develop a sound bargaining position for suppliers and efficient resource allocation. Cooperating with other firms could potentially reduce their opex with 25%. Thirdly, they face a high impact of a dry-hole exploration drilling on-shore. In the former actor field, the NAM could mitigate this uncertainty as large firms, but the current small firms have other resources and capabilities – resulting in a *new* issue related to this changing operator landscape.

6.6 REFLECTION ON APPLYING THE PLURALISTIC THEORY OF THE FIRM

The aim of the *pluralistic theory of the firm* was to create a comprehensive insight which elements determine upstream investments, and how policy facilitates these investments. The exploratory nature of the theory enabled this study to put forward a broad set of relevant elements, and in addition to that, make precise assumptions about the contribution of those elements to upstream investments. Applying this theory therefore allowed this study to consider a large set of elements, and focus on the interaction between those elements. In line with 5.6, the advantages of approaching the research domain from this *interactionistic* and *pluralistic* perspective have resulted in useful insights. Chapters 6.1 – 6.3 applied the three theories which are the foundation of the *pluralistic theory of the firm.* This resulted in extensive insight into the extent to which the gas roundabout policy facilitates upstream investments. Chapter 6.4 illustrated that the *pluralistic theory of the firm* also results in additional insight from a *methodological interactionistic* perspective. In addition to that, limitations of the individual theories were compensated by such an *interactionistic* approach. Some examples are the additional insight TCE provided in Porter's power of buyers, and the additional nuance RBV provided in the application of both TCE and Porter's theory. It can be concluded that by applying the *pluralistic theory of the firm,* limitations of the three individual theories can be compensated and additional insight is provided by the interactionistic approach. Results from this exercise can feed the debate on the Dutch upstream investment climate, and support policy makers to look beyond conventional approaches to make policy.

However, the limitations of this theory should also be recognized. The relative effects of the elements determining upstream investments are not only firm-specific, but they are also difficult to unambiguously compare. Where does the effect of public resistance relatively stand to the uncertainty of a dry-hole risk? Or where do transaction costs of sales agreement stand relatively to the *shadow of* decommissioning? The next step would be to use the exploratory insight of this theory for an operationalization on this limitation. This would involve normative insights about the relative position of the elements. A survey among *all* operators, also parties which are not involved in the current Dutch context can be a first step to do so. This study can therefore be seen as a decent starting point for such exercises, and future debates. The next PART will elaborate more on this.

PART III:

SYNTHESIS

7. SYNTHESIS

The two previous PARTs provided insights in the contribution of the gas roundabout policy to (i) the regulatory regime, and (ii) the extent to which the gas roundabout policy actively facilitates upstream investments. This chapter will emphasize on the interaction between the PARTs. This interaction can provide elementary insight to thoroughly understand both aspects of the research problem. Moreover, this chapter will elaborate on the lessons which could be learned from this study. The following research question will be answered:

How do the regulatory regime and the ability of the gas roundabout to facilitate investments interact?

First, the residual questions from PART I will be put in the perspective of insights from the PART II (7.1). Thereafter, the contribution of the gas roundabout policy to facilitating investments can be further explained, by incorporating insights from PART I (7.2). The third section will determine whether it is a problem that the gas roundabout policy does not actively facilitate investments, and does not actively contribute to the regulatory regime, by looking at the overall policy and objective of the gas roundabout (7.3). Thereafter, the main lessons from this study will be reflected upon. An integrated framework will be developed out of these lessons, aimed to support future policy making and -analysis (7.4).

7.1 FURTHER EXPLAINING THE REGULATORY REGIME OF THE GAS ROUNDABOUT POLICY

The contribution of the gas roundabout policy to the regulatory regime was addressed in PART I. It was concluded that the gas roundabout policy can best be approached from a process perspective. Also, it was concluded that the contribution of the gas roundabout policy to the regulatory is mainly a *frame* to which different actors can *tag* their individual problem and solution streams. PART I explained the potential added value of the *frame*, and also explained the dynamic, broad character of the gas roundabout policy. Moreover, the modes of *decision-making processes* on the regulatory regime was analyzed and evaluated. Applying policy analysis theories, including networks of actors, wicked problems and different views on natures of policies, enabled this study to understand the gas roundabout policy to a large extent. However, some residual questions could not be answered, and also the need for a more comprehensive analysis framework was stressed. Firstly, this section will answer the residual questions of PART I from out the perspective of PART II, concerned with *private* decision-making on investments:

- How can it be explained that the process was only limitedly fair? Were all *relevant* parties involved in the process? (7.1.1)
- What is the contribution of the *frame* to the attractiveness of the Dutch upstream investment climate, and what are possible pitfalls of the *frame*? (7.1.2)
- Was interactive decision-making suitable to engage with the actor-network? (7.1.3)

Section 7.4 will come back to the need for a more comprehensive and *integrated analysis framework*, adding to the needs stressed in paragraph 4.6.

7.1.1 FAIRNESS OF THE PROCESS AND ACTOR-INVOLVEMENT

The applied policy analysis theories assume that the *process-design* (De Bruijn and Ten Heuvelhof, 2008) is – or ideally should be – a conscious process. Including or excluding certain actors is a deliberate choice of the *process architect.* Although the process was perceived to be limitedly fair, EL&I indicated that they aimed for an open process. Possible explanations, other than a deliberate strategic choice, for the fairness of the process could be derived from PART II. These explanations will be described below and can add to the existing policy analysis theories. How can it be explained that not all actors were involved, resulting in a limitedly fair process?

A first explanation can be found in the *dynamics and development of the operator landscape* (see 6.3.2.4). It was identified that the current operator landscape consists of 16 operators, of which the majority are small

firms (also see appendix 7). As the gas hub consultative platform only involved a handful of large and medium firms in 2010, a large number of *currently* relevant parties were not involved in the process. This resulted in a process which was only limitedly *fair* from a process-perspective. Could EL&I have been aware of this in hindsight? As the operator landscape changed significantly over the years (see 6.3.2.4), and the involved actors (NAM, GdF, Wintershall, Centrica) actually represented the relevant majority *at the time* the platform was established, probably not. In hindsight, this explains why the process was limitedly fair. This is an important nuance which must be added to the policy evaluation criteria. For future decision-making on the gas roundabout policy, it urges the need to frequently analyze the dynamics of this operator landscape. EL&I should be aware which parties are relevant to involve and should therefore enhance their substantive insight on the presence and roles of the actors on the playing field. In general, is could be learned that a process should have eye for the dynamics and development of the relevant actors. The *process design* should be flexible to be adapted to a changing actor landscape.

A second explanation can be found in the *path-dependent* perception of EL&I to the research domain. It was indicated in PART II that *old buttons* related to the "Gasgebouw" (adjust midstream structures to facilitate investments, e.g. by SFP) might need a re-think in a new context. This also counts for the choice which parties to involve in the process. Historically, the invited parties were elementary actors in the Dutch E&P industry – for their role as *Groningen-producers* or their prolonged presence. During this *path-dependent* development of the Dutch natural gas policy, EL&I build long-lasting relation with these parties. This explained why it were these parties who were involved in the process. This path-dependent element subscribes to the need to have an *independent process-architect,* which is not biased based on existing relations or past events (see De Bruijn et al. 2003). Of course, the fact that these parties have these path-dependent relations also determines their interactions, norms and habits. An independent *process architect* should not overlook these elements as this could result in resistance of these parties. This subscribes to the theory of De Bruijn et al. (2003) concerning the *process architect*: be independent, but also be aware of the habits and routines of the actor-field.

In line with that, the third explanation is related to *power and politics*. Excluding parties which are or were prominent actors – and with that tax-payers and employers – might result in resistance of these parties. Although new actors might gradually take over this prominent role, 'incumbent' actors are probably of the opinion that they deserve respect and credits. Developing a policy or process which is aimed at long-term, future responses asks for a mix of parties which were powerful over the years, but might become less powerful in the future, and new parties which can be expected to become more powerful over the years. Such gradual future-aimed developments are challenging to incorporate in policy making, especially given the associated uncertainties. *Politics and power* in other *decision-making arenas* further add to that complexity. For example the role of Shell as being: shareholder of GasTerra, a prominent player in the "Gasgebouw", the operator of the country's most important natural-asset: Groningen, the biggest down-stream oil firm and the largest private Dutch employer and company as a whole. This can hardly be neglected in the *process design.* These complexities must be taken into account by a *process architect,* but do not exempt the Dutch government to objectively develop a fair and open process, also include parties of other nature.

Fourthly, there are also other interactions of EL&I with the operator, unrelated to the gas roundabout policy. These include bi-lateral contacts, an annual visit of EL&I to the operators and NOGEPA-interaction. Interactions in other *arenas* also contribute to the substantive insight of EL&I. This urges the need to also include interactions of actors outside the *arena-in-study*, in this research the *platform*, for a thorough analysis.

These factors are important drivers for any decision-making process related to the upstream investment climate. It adds to our understanding why certain parties were involved in the platform. Some of these explanations subscribe to the *process management* theory, where others illustrate the complexity of this particular research domain and add to those theories. These considerations should be taken into account in future decision-making, but ultimately this study has pointed which actors are *currently* relevant for this issue and urge the need to explore for a fairer process. Paragraph 9.1 will build forth on this, and illustrate *how* a

fairer process can add to facilitating investments. This section also illustrated that insights from PART II are elementary to take into account for comprehensive policy making, analysis and evaluation.

7.1.2 PITFALLS OF POLICY FRAMING

PART I concluded that the gas roundabout policy mainly is a *frame* (see 4.4). Insights from PART II illustrated that the *tagged* and *framed* policy instruments and objectives do not result in the desired situation where investments are actively facilitated to an extent that the policy objective of 30/30 can be met. Therefore, the involved parties will not be *satisfied* about the gas roundabout policy. Paragraph 4.2.2 pointed on the positive elements of *framing,* and explained why the gas roundabout policy is such a frame. Below it is described how insights from PART II can add to these insights on framing, by describing some pitfalls of a policy which is mainly a frame.

A first pitfall of framing is the extent to which the frame results in *actively* setting the right regulatory by creating both substance and support – which is the aim of the policy *process* in the dynamic network environment. As described, the frame can be used to e.g. create a sense of urgency, a common problem, a shared vision and stimulate actor interaction (4.2.4). Especially *policy framing* was functional in that regard, as it *conceptualized* the vision of EL&I and some other actors (i.a. Gasunie). However, the contribution of *issue framing* to the subsequent phases in the policy process is limited. The frame was functional to start the process and the discussion, but eventually a decision-making process has to result in a *negotiated* problem perception, both positionally and substantially *learning* of parties, and a policy which actively sets the right regulatory regime and facilitates investments. The pitfall of relying too much on this *frame* in subsequent phases of policy making can result in an undesirable situation. First of all it may hamper *positional* learning as the parties may only *tag* their problems and solutions instead of negotiating and discussing on each other's positions. In addition to that, the frame may hamper *substantive* learning as the parties may end up in only *tagging* their own issues to the frame, instead of a process aimed at an objective inventory of the most relevant problems and solutions. The frame may remain limited in a *cumulative* set of problem perceptions of individual actors, instead of a *common* problem perception or newly identified and negotiated *relevant* problems and solutions for the network as a whole. This urges the need to re-think where EL&I wants to use their frame for: is the gas roundabout frame intended to unite actors and create a vision and sense of urgency, or is the frame aimed to force all actors to develop 'the gas roundabout'? Obviously the latter does not subscribe to the rationale behind the gas roundabout policy (AER, 2005; EZ, 2006), and would not result in the required substance nor support. This also subscribes to the theory on *framing*, being a mean rather than an end. The *next step* in the policy process is to exploit this created sense of urgency and develop a decision-making process where both EL&I and the industry can learn positionally and substantially. To some extent this was done by establishing the platform.

A second pitfall of framing relates to the *scope* of the frame. PART II illustrated that the most important future challenges are not particularly related to the position of the Dutch natural gas value chain as a whole. The threat of substitutes, the power of buyers and the transaction costs associated with selling the gas have most to do with the establishment of a 'gas roundabout' (see figures 20 and 36). PART II identified that other issues, related to upstream in particular, are the most elementary. Parties are therefore not driven to see most of the gas roundabout as their concern – as it are mainly issues which are not related to the gas roundabout that matter to them (e.g. shadow of decommissioning, operators sitting on assets, permitting). Organizing a consultation process under the name *gas hub consultative platform* might therefore hardly be of interest to the parties as it seems that it has few to offer them. A frame which is too broad or mismatched with the most relevant issues of some parties will not stimulate these parties to bring substance and support to the process.

These two pitfalls illustrate that the *frame* gas roundabout policy should be used functionally – as described by the theories in box 2 – and that it cannot be expected that the frame will automatically and *actively* result in the right regulatory regime, support, substance and learning of parties. The frame should *actively* be succeeded by a proper *decision-making process* and might need to be *re-framed* so that it is aligned with the most relevant issues of a certain group of actors. For learning and realizing substance and support for an *active*

regulatory regime aimed at *actively* facilitating upstream investments, EL&I can rely on two complementing sources. Firstly, a suitable decision-making process resulting in a negotiated common perception of the issues. Secondly, a substantive analysis of the issues in kind. Framing can be a useful instrument to start or support the first, but nothing more.

7.1.3 INTERACTIVE DECISION-MAKING

PART II illustrated that there are many aspects which determine the attractiveness of the Dutch upstream investment climate, and that these differ among firms. This implies that the biggest challenge for EL&I is to decide and act upon all these different perceptions on problems and solutions. A decision-making process can be used to support EL&I in this, as it might result in substance and support but most of all that it may result in a *negotiated* common problem perception. An efficient decision-making process can provide insights in how issues are interrelated and how these could be ranked or stand relatively to each other. The process can be about normative perceptions and moving towards some consensus. How suitable is the applied interactive decision-making process to approach this challenge?

In 4.2.1 it was illustrated that interactive decision-making can result in some substance and support, especially when a large number of actors will be involved in the process. More challenging is to apply interactive decision-making when aiming at a *negotiated* common problem perceptions. This is not only important as it can guide EL&I in its hierarchical policy making on the actual instruments, but it can also result in private-collaboration. The combination of these two aspects is critical to address the most relevant issues identified in PART II, as *facilitating* investments can also occur by *stimulating* or facilitating private collaboration. Especially given the high variety of the upstream network, as illustrated in PART II, all actors should be involved in a process aimed at a common problem perception.

The nature of the problem and the applied decision-making process depended upon problem- and solution perceptions of the involved parties including EL&I themselves. The proposed instruments, and also additional issues identified in PART II, will only be incorporated in the policy when it has sufficient support of the involved actors, and when sufficient substance is brought into the process. As the problem perception of the involved actors (in the *platform*) on these proposed measures and residual issues is much lower than the problem perception of non-involved actors, it can be explained why there was not sufficient support. For example, off-shore operators such as Wintershall and GdF have a lower problem perception on permitting than non-included on-shore operators such as Vermillion or NPN. Their perception towards this entry barrier is lower. And because the involved actors have certain resources and capabilities, they cannot be expected to embrace initiatives regarding information distribution or cooperation as non-involved actors might do. In addition to that, the involved parties might not even be aware of certain issues of other firms, resulting in sub-optimal substance in the process. The involved oil firms cannot be blamed for overlooking issues of other actors. The gas roundabout policy therefore *satisfies* the large, and some medium firms, but overlooks the issues which are faced by small firms. Because these small firms have become increasingly important over the years, a *satisfying* policy should be enriched with the problem and solution perceptions of the small firms.

This brings us to the question: what is an alternative, more suitable decision-making process, aimed to gather substance and support, resulting in a policy that can actively facilitate upstream investments? This will be recommended in chapter 9.

7.2 FURTHER EXPLAINING THE SUB-OPTIMAL CONTRIBUTION OF THE GAS ROUNDABOUT POLICY TO FACILITATING INVESTMENTS

PART II concluded that the gas roundabout policy only facilitates upstream investments to some limited extent, and that many residual issues remain unresolved. Could EL&I have been aware of these residual issues, in hindsight? Many of the residual issues – such as the shadow of decommissioning, the need to actively approach new companies, sub-optimal information availability and sub-optimal activity levels of license holders – were already identified in the period prior to the development of the gas roundabout policy (NOGEPA, 2006; PRC, 2007; EZ, 2008). In hindsight, the government could therefore have been more aware of the presence of these issues. Possible explanations can be found in PART I, in order to answer this main residual question of PART II:

- How can it be explained that certain issues have been overlooked by the policy?

A first explanation relates to the limited fairness of the process. As not all relevant parties were involved, not only a limited amount of substance, but also a low *sense of urgency* was brought to the process. The *information asymmetry* between the industry and the government was therefore not overcome. By involving only a limited number of parties (notably incumbent large and medium firms), the negotiated problem perception – being the cumulative set of problem- and solution streams – did not result in a comprehensive insight to the issues which needed to be addressed by the policy. PART II of this research identified a large set of residual issues, negatively contributing to the attractiveness of the Dutch upstream investment climate. Because the process involved actors with a different problem perception (or even being the cause for some of these issues as infrastructure owners and incumbent licensees), no sense of urgency was involved in the process to address these residual issues. This was amplified by the pitfalls of framing, as described in the previous section.

Secondly, PART I described the perception of the Dutch government to stimulate upstream investments. In the old situation – especially before the unbundling of Gasunie – the government had the "Gasgebouw" as main *button* to facilitate upstream investments. When, in the new market and institutional context, this midstream *button* has become less effective, there is a need to reconsider available new or other buttons to push. The *methodological holistic* approach of the government was based on the belief that by changing the market and institutional structure (the "Gasgebouw"), market parties will invest. As identified by the framework, the upstream investment climate is characterized as *methodological interactionism.* Apart from a possible paradigm shift from midstream measures to upstream measures, the government could also consider to look at the issues which could be addressed by looking from a *methodological individualistic* perspective. The additional insight by looking from a *interactionistic methodology* was proven in PART II of this study. This urges the need to complement *process* with substantive analysis from out the suggested perspective to support policy making.

A third explanation is that all these issues were known to EL&I, but that it was decided not to translate these issues into policy for other reasons. These could be policy trade-offs and other Ministerial-responsibilities on other policy domains such as spatial planning, budgeting, European Antitrust or environmental policy. This urges the need to place the upstream natural gas policy within the wider context in which EL&I makes trade-offs between costs and benefits and usefulness and necessity.

Paragraph 7.4 will attempt to aggregate all the additional insights from 7.1 and 7.2.

7.3 CONTRIBUTION OF ADDITIONAL UPSTREAM INVESTMENTS TO THE GAS ROUNDABOUT

Why is it necessary for EL&I to aim for such a revised policy? The overall objective of the gas roundabout policy is to re-position the Dutch natural gas system, contributing to security of supply and the valorization of Dutch competitive advantages. To what extent does an attractive upstream investment climate contributes to these overall policy objectives of the gas roundabout?

SECURITY OF SUPPLY

The figure 41 below gives a simplified[6] representation of the Dutch natural gas balance over the period 2010-2030. In a business-as-usual (BAU) scenario – with an upstream investments climate were the potential upside is not valorized because the required investments were not actively facilitated (see EBN, 2012) – the Netherlands will become a net-importer around 2021. When the upstream investment climate is attractive to such an extent that the potential upside (230 of additional production) is valorized, this situation is postponed to 2026. This upside scenario would save 130 bcm of imports during that period (see figure 41). As the gas roundabout policy is aimed at security of supply by diversification on the long-term, enhancing indigenous production could deliver a substantial contribution. The figure 42 below indicates the required import to meet Dutch demand on the long run.

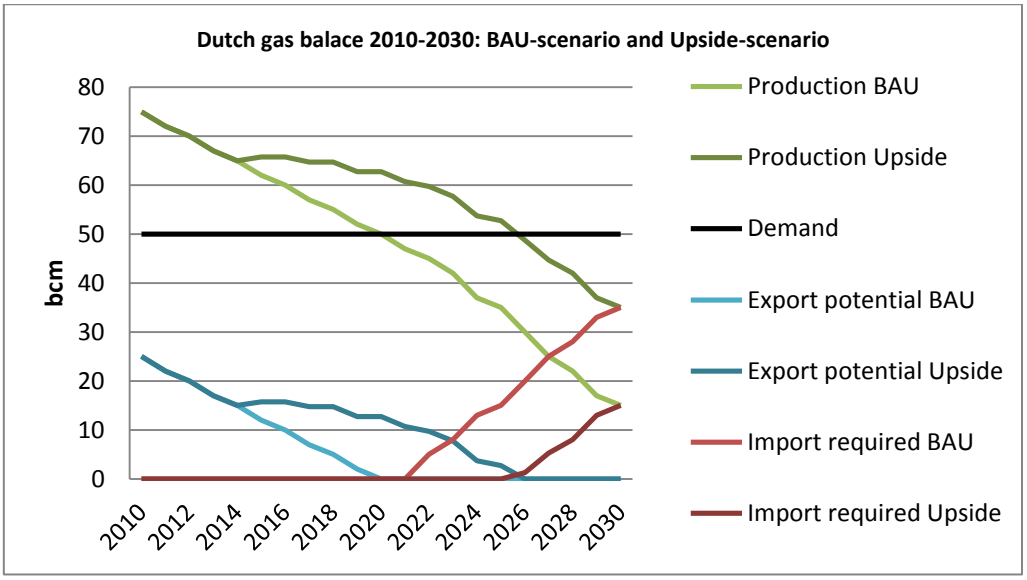


FIGURE 41: SIMPLIFIED DUTCH NATURAL GAS BALANCE 2010-2030 IN BUSINESS-AS-USUAL (BAU) AND UPSIDE SCENARIO. (SOURCE: EZ, 2008 FOR GRONINGEN PRODUCTION, EFNL, 2010 FOR DEMAND, EBN, 2012 FOR SMALL-FIELDS PRODUCTION)

Such long-term predictions involve numerous uncertainties[7], but actively facilitating upstream natural gas investments has the potential to significantly contribute to security of supply. Especially when it is considered that security of supply has the nature that the last cubic meters of import often come at the highest costs and (geopolitical) effort.

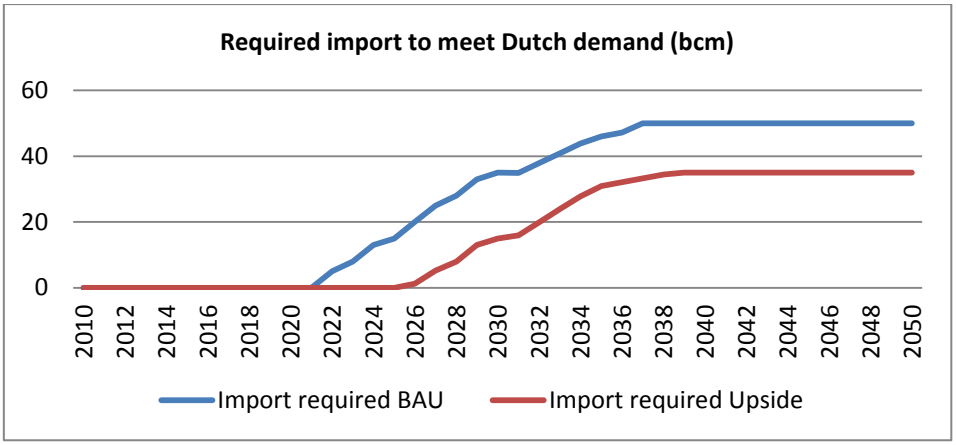


FIGURE 42: REQUIRED IMPORT TO MEET DUTCH DEMAND (SOURCE: OWN ESTIMATIONS, BASED ON FIGURE 41)

[6] Assumed that only surplus production will be exported, and not incorporates security of supply as seasonal flexibility (see CIEP, 2011) or as N-1 principle (see Brattle, 2010).

[7] Assumption that additional upside would gradually fall from 20 bcm in 2030 to 15 bcm, and will remain 15 bcm annually under the assumption that unconventional gas would mature.

The contribution of an attractive upstream investment climate to the overall gas roundabout policy objectives is therefore substantial. More research could provide additional insight by incorporating flexibility and supply-route conditions. In addition to that, postponing the shift from exporter to importer, and reducing the overall need for import, also results in an extended *window of opportunity* for midstream and downstream developments. When the sense of urgency for alternative supplies – such as LNG- or pipeline-imports, but also green-gas development – is somewhat reduced, it gives investors in these projects more time to consider alternatives and technological developments. Also, by maintaining indigenous production, the complete reliance on the market is reduced or postponed. Given the transition-phase of the markets (CIEP, 2012, Glachant, 2012), benefitting from indigenous production could lower the exposure to *child-diseases*.

These observations should be more substantiated by further research, but considered by EL&I and other policy makers. A graph with declining indigenous production rates should be interpreted with the necessary nuance, taking into account the specific characteristics of natural gas markets. Of course, midstream and downstream efforts –the other parts of the gas roundabout, see chapter 2 – are complementary to upstream efforts when security of supply has to be realized by facilitating investments in midstream infrastructure, and developments of liquid and well-functioning European gas markets.

VALORIZING COMPETITIVE ADVANTAGES

Although Brattle (2010) did not substantiate the relation between the gas roundabout policy and the additional production levels (as this study did), Brattle calculated the contribution of additional production levels on the Dutch economy. Over the period 2010-2020, they estimated a contribution of €11 billion to the total Dutch economy, as result of additional investments upstream. The total contribution of all elements of the gas roundabout policy is €21 billion (upstream, transport, storage, trade and R&D). Actively facilitating upstream investments would therefore deliver a substantial contribution to the total economic impact of the gas roundabout policy. In addition to that, Brattle (2010) assumed that these additional upstream investments would result in an additional employment of 68.000 job-years over the period 2010-2030.

Concluding, actively facilitating upstream investments would largely contribute to the policy objectives of the entire gas roundabout, because of the substantial contribution of additional upstream investments to the overall objectives of the gas roundabout: security of supply and the valorization of Dutch competitive advantages.

7.4 TOWARDS AN INTEGRATED FRAMEWORK FOR POLICY MAKING AND ANALYSIS

The main lesson with regard to policy and *wicked problems* in a *network* of *mutual-dependent actors* and policy makers characterized by *information asymmetry*, is that the *regulatory regime* – being the set of policy objectives, -instruments and -processes – strongly interacts with the *nature of the actor network* and the *nature of the research domain*. All these elements and relations among these elements are dynamic over time, and are related to the external context. This complexity is not completely recognized by the original theories on policy analysis (chapter 3) or the developed *pluralistic theory of the firm* (chapter 5). This chapter will attempt to develop a framework in which all these elements can be integrated. This can support future decision-making concerning the gas roundabout policy and upstream investments in particular, and policy making and analysis on *wicked problems* in *multi-actor* settings in general.

The most important limitations of the applied process-based *policy analysis theories* (see 4.6) are that:

- The evaluation criteria of a decision-making process are mainly aimed at a 'pure' process, and less suitable for a 'hybrid' decision-making process. It was stressed that the trade-off for policy makers between negotiation (a process aimed at support and substance resulting in actual policy decisions, *positional learning*) and consultation (*substantial learning*) is important to take into account in evaluating a decision-making process;

- Insight and policy analysis can be enhanced to move beyond the criteria *have any problems been solved* to *the contribution of the decision-making process to the policy-decisions (e.g. instruments)* or *the contribution of the policy to the research domain (e.g. facilitating upstream investments);*
- Not only the involved actors in the decision-making process, but all relevant actors should be analyzed for a more comprehensive insight into the decision-making process. Dynamics of the actor landscape can explain changing problem perceptions (6.3) and the fairness of the process (7.1.1). Also path-dependent relations, the power of certain parties and interaction between the policy maker and parties in other arena's can explain the fairness of a particular *process*;
- Path-dependent views of the policy-maker can explain their problem perception. In addition to that, the behavior of the policy maker should be analyzed in the broader policy context (7.1.1);

The most important limitations of the *pluralistic theory of the firm* for policy analysis are that (see 6.6):

- (Normative) insights from the actor network are required to operationalize the theory;
- The research domain is related to the policy-maker and actor-network by *problem perceptions*. The theory requires normative values to *rank* the relative contribution of the elements (e.g. entry-barrier, transaction costs) to firm's behavior;
- The theory does not concern the development of the policy, the *distinctness* of the contributing factors, and other issues related to the regulatory regime.

By developing an integrated policy framework, these limitations and considerations can be taken into account by future policy analysts and policy makers.

7.4.1 THE INTEGRATED POLICY FRAMEWORK

The figure below illustrates the *integrated policy framework.* This framework is established to add to the needs stressed in the previous section. Eventually, this *integrated policy framework* is aimed to structure future policy making and analysis.

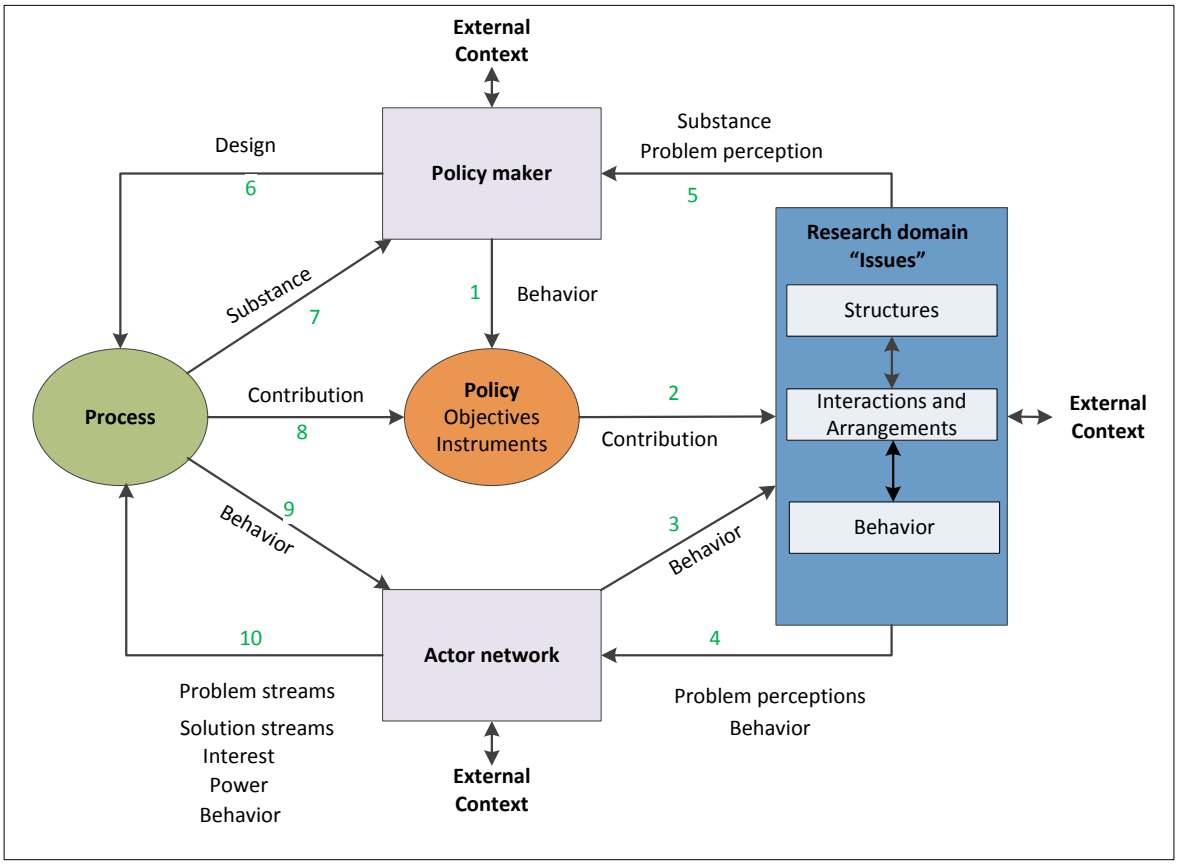


FIGURE 43: THE INTEGRATED POLICY FRAMEWORK

The framework will be described (7.4.1.1) and it will be stressed how it adds to the needs stressed in the previous section (7.4.1.2) and how it can be applied (7.4.1.3). Conclusions will follow (7.4.1.4).

7.4.1.1 ELEMENTS OF THE INTEGRATED POLICY FRAMEWORK

The framework consists of 5 main elements, which together are named the *policy context*. These elements will be briefly described below.

1. The research domain

In this research the research domain was "the Dutch upstream natural gas investment climate." In this general framework, the research domain can be any other as well. In general, any research domain can be characterized by structures, interactions and behavior of agents (Groenewegen et al, 2000). By applying the general approach of Ostrom, a specific framework (e.g. *the methodological interactionistic framework* in this research) can be developed to identify the elements and relations within the research domain. Also, the general approach of Groenewegen et al. (2000) can be applied to determine a suitable *methodology* to approach the research domain. When necessary, such a specific framework can be used to develop a theory (by using the general approach of Vromen and Groenewegen, 1996) or a model.

This first element of the *integrated policy framework* can be used to structurally determine the contribution of the policy to the research domain (relation 2) and the involvement of the actor network in the research domain (relation 3). This determines the extent to which the policy makers has autonomous power to influence the research domain, or to what extent they depend upon the actor network to realize their objectives. By linking the research domain to the problem perceptions of the policy maker and the actor network, the context and nature of the problem can be analyzed (see table 3). For example, hierarchy or network, dependency of policy makers on other actors, problem or problem perceptions, etc.

2. The *nature of the actor network*

The nature of the actor network can be characterized by its composition, closedness, variety, dynamics, etc. in line with the theory of De Bruijn and Ten Heuvelhof (2008). In addition to that, the dynamics of the actor network must be taken into account by the analyst (see 6.3.2.4). Also, the interaction of the actor-network with the external context must be included. This determines the involvement of actors in other arenas.

By analyzing the actor network more extensively, the contribution of the different actors to the research domain can be placed in a dynamic perspective (relation 3), different behavior of different actors within this research domain (relation 3, see 6.3) and different problem perceptions of actors – depending on their characteristics – can be analyzed (relation 4).

3. The *policy maker*

The policy maker can be analyzed on his problem perception, relatively to that of the actor network (relation 4 versus 5). The actual decisions of the policy maker on the policy instruments (relation 1) can be evaluated on the extent to which those problem perceptions are aligned. By linking the policy maker to the external context, it can be explained how the decisions of the policy depend upon other drivers such as other ministerial-obligations, formal and informal institutions, other policy domains (e.g. include *innovation contracts,* or *green deals)* and the path-dependent nature of the policy maker towards the problem perception. It is elementary to understand the dependency of the policy maker on the actor-network to realize its objectives (relation 2 versus 3), as this can be a driver for a certain process design (relation 6), either aimed at substance or support. Also, by linking the behavior of the policy maker to the external context, phenomenon like *tagging* can be explained.

4. The *decision-making process*

The decision for the policy maker upon a certain process (relation 6) can be evaluated upon the needs of the policy maker: generate (i) substance and (ii) support. Is the process suitable to (i) include the problem perceptions of actors into the policy trade-offs (relation 10 and 7)? Which problem perceptions are overlooked

(alignment relation 5 and 10), and how can this be explained? Possibly, this can be explained by the process design (relation 6), which includes or excludes certain parties, or the external context of the policy maker. (ii) Is the process suitable to generate sufficient support to (a) engage in the process or create a sense of urgency (this can explain strategies such as framing). Or, (b) is the process suitable to influence the behavior of the actor-network (relation 9 and 3), or actually contribute to the (negotiated) content of the policy (relation 8)?

5. The actual *policy*.

Lastly, the actual policy can be analyzed on its contribution (relation 2) to the research domain. Also, it can be determined how the policy was developed. The policy can be the result of the decision-making process (relation 8), or the behavior of the policy maker (relation 1). The latter must be placed in the perspective of the external context of the policy maker, as this allows the analyst to *trace* the objectives and instruments of the policy. Finally, it can be determined how the contribution of the policy (relation 1) corresponds with the problem perception of the actor-network (relation 4), are there any residual challenges? The existence of certain residual challenges can, in turn, be explained by the external context of the policy maker (the policy maker is aware of these challenges but decided not to address these, because of e.g. European antitrust or other ministerial-responsibilities) or the substance associated with the policy maker's decisions (the process was insufficient to generate sufficient substantive insight about the challenges).

7.4.1.2 ADDING TO NEEDS

By structuring policy analysis according to the *integrated policy framework,* some of limitations of the current theories can be mitigated.

Firstly, the framework supports policy analysts to take into account the differences between different modes to policy making. Policies which are merely process-based (the policy depends completely on relation 8), merely hierarchical (the policies depends completely on relation 1) or hybrid modes can all be analyzed. This insight can be linked to the trade-off of the policy maker, as some policies require substance from the actor network (relation 7) when the problem perception of the policy maker is limited due to information asymmetry (relation 5). Also, the decided mode of policy making can be linked to the needs of the policy maker – being their dependency on the actor network to realize their objectives (relation 3 relatively to relation 2).

Secondly, the framework can be used to determine the contribution of the decision-making process to the content of the policy (relation 8), and most importantly the contribution of the policy to the research domain (relation 2).

Thirdly, the framework stimulates the analyst to study the actor-network more thoroughly, in relation to (i) the dynamics of the network, (ii) involvement of actors in other arenas and their power (external context), (iii) their different problem perceptions, and (iv) their involvement and behavior associated with the decision-making process. These aspects can explain the design of the decision-making process, the fairness of the process and the extent to which the policy contributes to the problem perception of those actors.

By analyzing the external context of the policy, certain phenomenon like path-dependent beliefs on the research domain and the interdependency with other policy domains can be taken into account. This is especially relevant to *trace* the contribution of the policy maker to the policy.

Also, the framework emphasizes on the normative insights which are required to operationalize insights from the research domain (relation 4). It illustrates how the involvement of certain actors with certain problem perceptions (relation 6 and 10), can result in certain policy instruments (relation 8) or insight for the policy maker (relation 7).

Lastly, the framework supports to determine to which extent the policy changes the behavior of the actor-network (relation 3), derived from their involvement in the process (relation 9) or changes made to the research domain (relation 2 and 4).

7.4.1.3 APPLICABILITY

The framework can be used for multiple purposes, by both policy analysts and policy makers. This applicability will be briefly described below.

In general, the framework should be used as described by Ostrom (2005). It is a metatheoretical language which helps to structure the most relevant elements and relations between these elements to approach a policy problem. The framework should not be used prescriptive, but assists the policy analyst to link different disciplines (policy, economical, behavioral etc.) and supports the analyst to decide upon relevant theories for in-depth analyses.

APPLICABILITY FOR POLICY ANALYSTS

Policy analysts can use the framework to decide upon relevant theories for policy analysis and research-domain analysis. By identifying the context and nature of the problem (derived from the research domain in general, and the involvement of the actor network) and the content of the problem, the analyst can determine the most relevant policy analysis theory. For example, when the policy maker can hierarchically and fully-informed decide upon the policy to realize its objectives, and does not depend on the actor-network for support or substance, the project-approach to policy analysis is the most relevant. The theories of e.g. Hoogerwerf (1998) can be used to make precise assumptions about the most relevant elements and relations in such a case (only relations 1, 2, 5).

In addition to that, the framework supports the policy analyst to develop specific frameworks, theories or models to determine the contribution (process-approach) or effects (project-approach) of the policy to the research domain (relation 2). This development can be conducted along the general guidelines provided by Ostrom (2005), Groenewegen et al. (2000) and Groenewegen and Vromen (1996).

Moreover, when the context and nature of the problem require a process-approach, the framework can support the analyst to analyze and evaluate (monitor) the policy on the following criteria:

- Decision-making process: set-up (relation 6 and 10)
    - Is the process set-up fair (see De Bruijn and Ten Heuvelhof, 2008: core-values, etc.)
    - Are all relevant actors included in the process?
    - Is the set-up (e.g. consultation/hybrid vs negotiation/classical process-design) aligned with the needs of the policy maker and the actor network? (e.g. can it result in enriched substance, can it result in a negotiated problem perception, can it result in policy instruments or agreements, does it raise the interest of the actor-network to bring in substance and support)
- Decision-making process: contribution to the policy and actor-network (relation 7, 8 and 9)
    - Does the process contribute to substance for the policy maker? (substantial learning)
    - Does the process contribute to the behavior or problem perception of the actor-network? (substantial and positional learning)
    - Does the process contribute to the policy? (agreements between policy maker and actor-network on e.g. objectives or instruments)
    - Have long-lasting relations developed? (see De Bruijn and Ten Heuvelhof, 2008)
- Policy: content
    - What are the objectives of the policy, how are these objectives developed (relation 1 and 8) and what is the distinctness of these objectives?
    - What are the instruments of the policy, how are these objectives developed (relation 1 and 8) and what is the distinctness of these objectives?
- Policy: contribution to the research domain (relation 2)
    - What is the contribution of the policy to the research domain?
    - How does this contribution add to the problem perceptions of the policy maker and the different actors?

By elaborating on these criteria, and using the research domain, external context and actor-network as sources for explaining these criteria, the framework provided a structured approach to analyze and evaluate policies from a process-perspective more thoroughly. This study illustrated how all these sources can be used to explain and analyze policy.

Finally, the framework makes clear that insight from the research domain (e.g. by applying the pluralistic theory of the firm) requires the involvement of the actor network to operationalize these insights or to rank these insights for a comprehensive insight in the research problem.

APPLICABILITY FOR POLICY MAKERS

The integrated policy framework can also be of use for policy makers. Firstly, it provides them guidelines how the contribution of policy (relation 2) to the research domain can be analyzed. Policy makers can use or develop a framework, theory or model as this can substantiate their problem perception (relation 5). Secondly, it can support their exploration for trade-offs which have to be made regarding the design of the decision-making process (relation 6). For example:

- Information asymmetry: do the policy makers have sufficient insight on the research domain to make substantiated decisions (relation 1 and 5)? Or is a process required to generate substance out of the actor network? (relation 7)

This is especially relevant when the policy-context is characterized by a variety of actors who all have normative problem perceptions. A process might add to the substance of the policy maker in general, but most importantly, the process can aggregate process perceptions and support the ranking or prioritizing of problem perceptions. A process can result in substantial and positional learning, adding to the information asymmetry. A combined approach can also be applicable. For example, when the policy makers have developed a theory to explore for the contributing factors of the policy to the research domain (e.g. pluralistic theory of the firm), they can decide upon a certain process which is aimed to operationalize these insights or rank these insights.

- Dependency on the actor network: do the policy makers have autonomous power to contribute to the research domain (relation 2), or is there a dependency on the actor network to realize the policy objectives (relation 3)

This might determine the mode of decision-making process. When the policy maker depend upon the actor network, it might be required to negotiate on (certain aspects of) the policy content (relation 8). Also, it can be possible that the policy makers want to directly influence the behavior of the actor network (relation 9), by e.g. facilitate cooperation or private-collaboration as result of the decision-making process.

7.4.1.4 CONCLUSIONS

This chapter generalized the created insight in this research. The combination of insights from the research domain (PART II) and the policy analysis domain (PART I) are essential to thoroughly understand the interaction between both worlds (7.1-7.2). Fur future research, the *integrated policy framework* provided a structured approach to analyze and evaluate policies and research domains of different topics. Examples could be industry-politics, energy security of supply, regulation of electricity markets, public-transport etc.

Although policy analysis remains a tailored exercise (an analyst is still required to decide upon relevant theories for the policy analysis – project vs process – and has to develop a specific framework, theory or model for research-domain analysis), this research has provided an integrated view on how a structured approach can be developed and conducted.

8. CONCLUSIONS

This chapter will conclude this research by answering the main research question:

What is the contribution of the gas roundabout policy to the attractiveness of the Dutch upstream investment climate?

As stated in the introduction, this will be determined by addressing the contribution of the gas roundabout along two axes. (i) Determine to what extent the gas roundabout policy is actively aimed to develop the right regulatory regime in which upstream investments take place (PART I), and (ii) determine to what extent the gas roundabout policy actively facilitates the required investments to realize the 30-30 policy objective (PART II), as suggested by the policy publications (EL&I, 2011). These two criteria will be examined in chapters 8.1 and 8.2, and will fill the practical knowledge gap. Section 8.3 will fill the scientific knowledge gap.

8.1 THE RIGHT REGULATORY REGIME?

Based on theoretical considerations in chapter 3, it was concluded in chapter 4 that the regulatory regime of the gas roundabout policy – being the policy objectives, instruments and processes – can be best be approached from a process-perspective, rather than a classical project-perspective. A process-approach to policy analysis and evaluation is more suitable for the context and nature of the problem, characterized by the mutual dependency of the government with a *closed and variety* network, information asymmetry and different problem perceptions and interests. The context and nature of the problem demands a dynamic and adaptive policy which is open for both *substantive* and *positional* learning by the government. As it are firms who have the power to realize the government's objectives, support from the actor-network is essential.

The dynamic and incremental character of the gas roundabout policy is therefore understandable. Also the interrelatedness of the policy with other policy domains (e.g. innovation-policy), path-dependent beliefs and structures (e.g. the Gasgebouw and statement that the gas roundabout must be seen as *brown-field-project*), and adaptation of the policy to external developments (e.g. Russia-Ukraine crisis) and the actor-network (e.g. EBN's *30/30 exercise*) indicate that the policy attempts to satisfy a wicked problem.

First of all, the policy is aimed to conceptualize the beliefs of the Dutch government – the *informal institutions* – on the desired future position of the Dutch natural gas value chain. The gas roundabout policy can therefore be seen as a *policy-frame* according to Korsten (2008). The objectives and *problem perception* of EL&I – security of supply and valorizing the Dutch *competitive advantages* – are not aligned with objectives and *problem perceptions* of other actors in the network. These actors have their own problem perceptions, e.g. maximize share-holder value. By involving *some* actors (by means of the *platform*) and taking into account *some* problem perceptions and solution streams from out the actor-network (e.g. NOGEPA, 2006; EBN, 2009; EL&I, 2010), the gas roundabout policy proved that it can be sufficiently adaptive to the problem-context and is eager to some *learning*. With that, the government took a first step to satisfy the wicked problem, together with the industry. However, to determine the extent to which the policy *actively* contributes in setting the right regulatory regime to *actively* facilitate upstream investments, the policy was analyzed and evaluated from a process-perspective.

By tracing the objectives and instruments of the gas roundabout policy, it was identified that the gas roundabout policy is mainly an *issue-frame* to which EL&I and actors can *tag* their problem and solution streams. The objective was adapted to the problem perception of EBN, and its broad nature allowed for *goal-stretching* and *coupling and de-coupling* of issues by EL&I. But ultimately, the existence of the policy objective to maximize Dutch upstream production is independent from the existence of the gas roundabout policy.

Also with regard to the policy instruments, the existence of these instruments could be traced back to already existing measures, the evaluation of the Mining Act and other policy initiatives (innovation contracts). Therefore, the existence of the gas roundabout policy did not *actively* contribute to the existence of these

instruments – but nevertheless presents these objectives and instruments as *achievements of the policy*. (EL&I, 2011:7) Although some potential benefits can be subscribed to the *issue-frame* gas roundabout (see 4.2.4), the *active* contribution of the gas roundabout policy to the regulatory regime is very limited. From a process-perspective, this would be no *problem* when all parties would be satisfied about the contribution of the *framed* policy measures to attractiveness of the Dutch upstream investment climate. PART II illustrated that this is only the case to some extent.

The decision-making process was characterized as *interactive decision-making*, which allowed the government to generate interest for their issues, some substance on the problem and solution streams of the actors and possible support from the actor-network. However, the evaluation of this process pointed out that only some parties were invited in this decision-making process – making this process limitedly *fair*. In addition to that, the platform was merely aimed to consult the government and not to develop a common problem perception or negotiate on possible measures. The limited fairness of the process, and limited substance which was generated from out the process, are reasons why the policy has overlooked some residual issues identified in PART II. Although some relations were build, some problems were solved, and some learning occurred, the decision-making process leaves room for improvement (also see 7.1.3).

The limited fairness of the decision-making process was explained by the development of the actor landscape, the path-dependent problem perception of EL&I, and power of certain actors. Also the interrelatedness of this policy with other interaction-arenas, policies and ministerial-obligations are important to consider in policy evaluation. In hindsight, EL&I could not be blamed for excluding some parties. Nevertheless, the importance of the substance and support from the *new* actor-network urges the need to seek for a decision-making process which more actively engages with the actor-network.

Section 7.1 pointed out some important *pitfalls* of framing which can also explain why the policy did not *actively* contribute to the regulatory regime. The frame should *actively* be succeeded by a proper *decision-making process* and might need to be *re-framed* so that it is aligned with the most relevant issues of a certain group of actors. Because the *framed policy means* do not actively facilitate investments (PART II), and because the *regulatory regime* does not *actively* aim to identify *and* consider problem- and solution streams from all current relevant actors, there is a need to re-think the gas roundabout policy both in terms of the policy content and the policy process. The next chapter will provide recommendations which could guide such re-thinking. Approaching the upstream investment climate in a more comprehensive way, taking into account the *interactionistic* nature of the research domain can be the key to a policy which is *actively* aimed to contribute to the attractiveness of the Dutch upstream investment climate. Elementary is the question what an alternative, more suitable decision-making process could be, aimed to gather substance and support, resulting in a policy that can actively facilitate upstream investments. The next chapter will provide some recommendations for that.

8.2 FACILITATING INVESTMENTS?

PART II identified that the *direct factors* of the gas roundabout policy positively contribute to the attractiveness of the Dutch upstream investment climate, as these actively facilitate investments in approximately 121 bcm of additional production, when the policy instruments are deployed optimally.

The *indirect* contribution of the gas roundabout policy – stemming from the development of the virtual and physical hub can be expected to deliver a neutral contribution to the attractiveness of the Dutch upstream investment climate. The emergence of a *gas roundabout* gives producers luxury or choice, as the presence of the small-fields policy and a liquid wholesale market results in a *redundant* possibility to mitigate demand and volume uncertainty. This development also implies that the old government paradigm – focusing on midstream aspects to facilitate upstream investments – needs a re-think. The influence of the government to facilitate investments by midstream measures such as the SFP can also partly be provided by a liquid market – but not entirely. Section 7.3 pointed at the contribution of increased upstream production to the development of these

other parts of the *gas roundabout*. Remaining such a redundant, or hybrid, policy structure for upstream investments (with continuing the SFP) can possibly deliver a positive contribution to both upstream and midstream developments.

Because the gas roundabout policy does not *actively* facilitate investments to the required level (230 bcm), additional efforts are needed. The remaining 109 bcm can be valorized by market parties, facilitated by an *active* policy when the Dutch government investigates and considers additional measures to mitigate the residual and unaddressed investment hurdles. These hurdles were not addressed by the current gas roundabout policy because not all relevant parties were involved in the process, resulting in a *limited problem perception*, *lacking substance* and low *support*. Other explanations why these hurdles – of which some were already known to EL&I – were not incorporated relate to the nature of the policy context. Examples are the *politics and power* of some actors, or trade-offs made at EL&I in a broader policy context.

This research identified a large and diverse set of issues which could be addressed by policy, facilitating upstream investments to a more *satisfying* extent. The interaction between the government (as policy maker) and the market parties (making the investments) is elementary, and needs thorough cooperation as addressed above. The declining industry phase has resulted in a new context which has to be considered by policy makers, involving other actors with other issues. The main challenges of the future, asking for active facilitation of the government are:

- Sub-optimal exploration activities;
- Sub-optimal production activities;
- Increasing opex;
- Regulatory burdens and public resistance on-shore;
- Shadow of decommissioning for off-shore infrastructure.

Section 7.2 illustrated that the limited fairness of the decision-making process, the interaction with other policy-domains or limited (path-dependent) insight can be possible drivers for overlooking these challenges.

Eventually, it are the market parties who have to mitigate these threats. But because of the nature of upstream investments, firm's behavior and resources, and the importance of upstream production for the Dutch government, a *facilitating* or even *coordinating* role of the government is desired to mitigate these issues. The next chapter will suggest some measures which could be considered by the government. As EBN is the *bridge* between the Dutch government and the industry, also a special role can be seen for them.

Answering the main research question briefly, the contribution of the gas roundabout policy to the attractiveness of the Dutch upstream investment climate is limited for two reasons. Firstly, the policy did not *actively* establish an optimal regulatory regime, nor a very satisfying decision-making process, which both should be aimed at gathering substance and support of the industry. By mainly *framing* existing initiatives, and conducting a limitedly fair *interactive decision-making process,* the gas roundabout policy did not substantially contribute to a regulatory regime in which upstream investments have to take place. Secondly, the measures *framed* as *gas roundabout policy* only *actively* facilitate upstream investments to some extent, and many issues remain unresolved. In hindsight, this study explained why these two findings are the case. Though some positive points were identified on the gas roundabout policy, the identified future challenges – both content- and process wise – urge the need for a re-think how EL&I intends to meet the objective to produce 30 bcm in 2030 from small fields. Recommendations for this re-think are provided in the next chapter.

By answering this main research question, the practical research objective is met as the main practical knowledge gap was filled by this research.

8.3 SCIENTIFIC RESEARCH OBJECTIVE

The second objective of this research was to fill the scientific knowledge gap. It was stressed that it is unclear how the contribution of policy to the attractiveness of an upstream investment climate can be analyzed from a scientific point of view. Therefore, this study applied, combined and developed multiple theoretical perspectives to contribute to that scientific need.

It can be concluded that the choice for a suitable policy analysis and evaluation perspective depends on the context and nature of the problem, the content and objectives of the policy, and the decision-making process and actor-involvement. This study positioned two perspectives relative to each other: the project-based and the process-based approach, summarized in table 3. It is concluded that distinguishing between the two perspectives can be a useful theoretical *starting point* for policy analysis.

This research applied the *process-based* approach to policy making, -analysis and –evaluation. It can be concluded that this theoretical approach proved to be capable in providing useful insights. However, also some limitations of this theoretical approach were identified.

The theoretical *evaluation criteria* are most applicable for outcomes of a *negotiated* process. In the case of the gas roundabout policy process, it is questionable whether the outcomes of the platform were actually negotiated. The platform was not intended to negotiate on outcomes, but rather to consult EL&I about possible problems and solutions. In addition to that, there are also other interactions of EL&I with the industry, so strictly applying the theoretical criteria may result in an incomplete picture. Another limitation of the theory is that there are also other elements which determine e.g. actor-involvement and process-design. These factors can be related to e.g. power and politics, or path-dependent beliefs or insights of the policy makers. It is challenging to include those factors in a theoretical perspective, but important *explaining power* can be derived from these elements. The most important limitation of the *process-approach* for this research was that is remains limited to the question whether *some* problems are solved*,* and does not provide guidelines how an analyst can determine the *contribution* of the policy to the research domain. These limitations urged the need to combine the useful policy-analysis theories with other, e.g. economical, theories which can provide further insight in both the research domain and the policy.

To contribute to those limitations, and aimed to fill the scientific research gap, the *integrated policy framework* was developed. This framework is applicable to structure policy-analysis of *wicked problems* in research domains characterized by a *multi-actor* context. The main added value is that is incentivizes a policy analyst to address both the regulatory regime – being the policy objectives, instruments, and process – and the research domain, together with the *multi-actor context*. Applying the framework forces an analyst to go beyond the theoretical criteria, and allows for synergy (as illustrated in chapter 7.4). Still, policy analysis remains a *tailored* exercise, as developing a theory or model to determine the contribution of the policy to the research domain is case-specific.

To develop a theory which can make assumptions about how policy *contributes* to the attractiveness of upstream investments, this study conducted a sequence of theoretical steps. First, this research applied the theoretical guidelines of Ostrom (2005) to develop the *methodological interactionistic framework* and to identify possible relevant theories: Porter's Five Forces Theory, Transaction Cost Economics and the Resource Based View. The *methodological interactionistic* framework is generally applicable to the specific research domain of upstream investments. It can be concluded that Ostrom's general guidelines to develop a theoretical perspective are a useful starting point. The specific *methodological interactionistic* framework can support future research on policy and upstream investments, as it did in this study. Ostrom's guidelines did not provide insights how to *combine* theories. This limitation was overcome by applying the theories of Groenewegen and Vromen (1996), who addressed theoretical *pluralism.* These considerations proved to be a useful step to develop the *pluralistic theory of the firm.* It can be concluded that this *pluralistic theory of the firm* successfully compensates for the limitations of the individual three theories, and provides a theoretical perspective which is

relevant to *theoretically* determine the contribution of policy to the upstream investment climate. Especially as it is suitable to take into account the *methodological interactionistic* nature of the research domain, and takes into account *all* relevant elements of the *methodological interactionistic framework.* It can be concluded that by applying both Ostrom's and Groenewegen and Vromen's guidelines, a structured approach to develop a theoretical perspective is found. This approach is also incorporated in the *integrated policy framework.*

The *pluralistic theory of the firm* also has limitations. For this research, the theory can contribute to explore and identify different variables, and make precise assumptions about these different variables – and the interaction with other variables. The variables (e.g. the contribution of the gas roundabout policy to the variable "permitting", and the extent to which permitting has a positive or negative contribution to the upstream investment climate) are, however, of different nature. This makes it hard to "rank" or "compare" the *relative* contribution of these different variables, especially as these variables may originate from three different theories. The main contribution of the theory is the *interactionistic* and *comprehensive* or *pluriform* insight, adding to the needs of the shortcomings of the individual theories and enabling this study to answer the research question. The product of applying the *pluralistic theory of the firm* is therefore more a comprehensive overview of the relevant variables in the research domain, and how these variables interact, than a precise explanation of the contributions of the policy.

This limitation also applies for the *integrated policy framework* and the *methodological interactionistic framework.* Both frameworks, and the *pluralistic theory of the firm,* can support policy making and analysis in a descriptive, general and *exploratory* way. It remains a challenge to operationalize the frameworks, and particularly the theory; as such an operationalization involves *normative* perceptions of the contribution of the policy to the research domain. Involving *normative assumptions* is inevitable as the research concerned a *wicked problem.* By conducting interviews, a representative overview of the normative assumptions was provided. When the number of actors would be larger, operationalizing the theory and framework becomes labor-intensive. These limitation – related to the scalability – can possibly be overcome by including e.g. surveys.

This study added to the scientific knowledge gap. By combining theoretical insights from both the *policy-perspective* and the *research-domain-perspective*, it can be explored and analyzed what the contribution of policy is to the research domain. As such an approach was not yet present, this research developed the *integrated policy framework.* By building forth on existing *policy-perspectives,* and by developing the *pluralistic theory of the firm,* this study added to the scientific needs. Especially the interaction between these two worlds, as illustrated in the synthesis part, can provide useful insight for analysis.

9. RECOMMENDATIONS

This chapter will make recommendations which are aimed to amend the gas roundabout policy. The recommendations will build on insights from both PART I and PART II, and the synthesis and conclusion of the previous chapters. The following research question will be answered:

How can the gas roundabout policy be amended?

In general, these recommendations aim to make the gas roundabout policy more "satisfying" by amending the decision-making process and regulatory regime (9.1), and by amending the content of the policy so that it more actively facilitates upstream investments (9.2). Ultimately, the former cannot be seen separately from the latter as that is one of the main findings of this study.

9.1 TOWARDS A MORE *SATISFYING* REGULATORY REGIME

Indicated in the previous two chapters, EL&I could ask itself what an alternative, more satisfying, decision-making process could be. More satisfying means a process aimed to more actively gather substance and support, resulting in a policy that can actively facilitate upstream investments. Although a separate study could be conducted to answer this question properly, this paragraph will sketch an option to consider. The other elements of the regulatory regime – policy objectives and instruments – are addressed in the next paragraph.

A NEED-BASED DESIGN

To determine how a more *satisfying* decision-making process can be developed, it is essential to understand the *needs* of the *network*. The main needs of EL&I are to (i) generate support for their policy objectives and problem perceptions on a high level – security of supply and maximum valorization of Dutch competitive advantages – and (ii) to generate substance to mitigate the information asymmetry. Other involved actors in the network have completely different needs, interests, problems and solutions. Key is therefore to design a decision-making process which *satisfies* all involved parties. Actors in the network need support for problems and solutions at a lower level of specificity compared to EL&I. These needs mainly related to sub-objectives such as "maximize Dutch upstream production" or even "optimize the upstream investment climate for our firms' projects." These different needs must be thoroughly understood by EL&I. Because of their specific needs and interests, it is not likely that upstream actors will support or be interested in a policy which is aimed to "maximize Dutch competitive advantages." These actors might become more interested when the policy will be segmented, and one of the domains will be aimed to "optimize the Dutch upstream investment climate." This already was understood by EL&I by segmenting the working groups of the platform, but needs to go beyond that as the current regulatory regime and decision-making process were found to be limitedly satisfying – as was concluded in the previous chapter.

Examples from similar initiatives and policies can be seen in the UK and Norway (see appendix 8 and 9), which established a special program aimed to optimize the upstream investment climate. In the UK, the PILOT initiative facilitates a unique partnership between the UK oil and gas industry, and the government. DECC (2012): "The government and industry cooperate to deliver quicker, smarter and sustainable energy solutions to secure the long term future of the UK upstream production, and ensure full economic recovery of resources." This initiative is highly successful in establishing private-partnerships, but also in establishing a regulatory regime aimed to maximize UK production. PILOT not only brings together private parties, but also provides the government *substance* on problems and solutions. In addition to that, many industry-wide *supported* initiatives were suggested and implemented in the regulatory regime by PILOT, such as the Promote Licenses, Fallow Fields, Stewardship and other. In Norway, OG21 has the similar aim.

Given these positive examples, the first recommended of this research is to consider the possibilities for a **"Dutch PILOT" program**. Such a program must be aimed at a long-term optimization of the Dutch E&P industry, together with the industry.

What are the strong points from the two examples? And based on the nature and character of the problem and network, how can such a program be designed for the Dutch case? Ultimately, such a program must result in *substance* and *support*, two elements which are currently limited in the gas roundabout policy related to the upstream investment climate. Based on concepts of De Bruijn et al. (2003), it is recommended to apply *process management* to develop such a program in the Netherlands. Below, *process management* will be positioned in opposite to the currently applied *interactive decision-making.*

PROCESS MANAGEMENT: THE CONCEPT AND POSSIBLE GAINS

When complex decisions have to be made in a situation with multiple actors, who interact in a network with information asymmetries, and different problem- and solution perceptions, PART I has already indicated that the political perspective to decision-making is more suitable than the rational model of decision-making. De Bruijn et al (2003) suggest applying the political perspective by using 'process management' (De Bruijn et al, 2003:2).

A first argument to apply process management is that it reduces *substantive uncertainty*. By testing different sources of information against each other, information quality may be improved. All *relevant* parties should be involved in a *process managerial setting* to enhance substantial learning, by e.g. extending the identified issues from chapter 8.2. These relevant actors comprise large, medium and small firms. By establishing such a *process towards a "Dutch PILOT,"* more substantive insight can be created about the main problems, solutions and the role of the government.

A second argument for process management is that it enriches problem definitions and solutions. Process management tests different perceptions and beliefs about problems, and testing different solutions on each other may have an enriching effect. Also for the individual views of actors, by creating understanding of each others' views. This can be used for *positional learning,* and may *rank* issues identified in chapter 8.2. Other arguments for process management are related to the dynamic, transparent character. (De Bruijn, 2003:22-23).

ADVANTAGES OF PROCESS MANAGEMENT OVER INTERACTIVE DECISION-MAKING

With *interactive decision-making*, it is the government who determines the rules of the process, brings in the substance, and determines the duration of the process. With process management, these aspects of the process are decided upon jointly by all relevant actors. It is up to the actors to decide which issues are part of the process. Issues such as the fiscal regime will not be negotiable, but other issues – especially those who demand public-private cooperation – can be negotiable, such as measures to mitigate the shadow of decommissioning.

Furthermore, process management demands for more *commitment to cooperation* between parties and is focuses on the network-character. Approaching the gas roundabout policy as a spatial planning consultation will not properly involve the required politics. Moreover, process management is more focused on mutual dependency instead of consultation and recognizes that parties will only join the process when it has something to offer. Also, process management is better capable to mitigate *power play* and *strategic behaviour* compared to the more limited *interactive decision-making* (De Bruijn et al. 2003)

Based on the above mentioned advantages of process management compared to the currently used decision-making process, it is recommended to investigate the possibilities to apply 'process management' for decision-making processes which are related to the gas roundabout. When the Dutch government indeed wants to create a decision-making process in which "no single actor in charge, and there is no hierarchical relationship for decision-making or guidance" (EL&I, 2011) and establish and deploy the gas roundabout policy "together with the industry" the current decision-making process could be replaced with a *process management* approach.

In brief, process management can move the regulatory regime beyond the frame to which parties can tag their problem and solution streams, resulting in more positional and substantial learning.

A second recommendation for this study is therefore to consider **a *process management-approach* to establish the "Dutch PILOT" program**, or at least adapt the current regulatory regime of the gas roundabout policy to allow more *process* instead of the limited *interactive decision-making.*

Future research is recommended to design such a process. It is recommended to conduct such a study on the intersection of both *process*- and *institutional design.*

Concluding, by making the gas roundabout policy more fragmented or tailored to the upstream research domain, and by (substantively) adding to the needs of relevant parties, it is more likely that these parties will actually become involve in the *process.* This can result in more substance and more support. Ideally, the Dutch government should aim to develop a "Dutch PILOT" and apply the process-perspective to decision-making and a design of future decision-making. The UK and Norwegian examples have proven to be successful, lessons could therefore be learned. Such an initiative adds to the needs of the industry, and matches with the changing context in which the Dutch government has to look for other *buttons* to push in order to realize its objectives, taking into account the *interactionistic* nature of the research domain and the *new* actor-network.

9.2 TOWARDS MORE ACTIVELY FACILITATING INVESTMENTS

To more actively facilitate investments, the identified main challenges in 8.2 must be actively addressed by the industry and the government. In line with the previous recommendations, identifying the problems and solutions can best take place in a *process-environment* where all relevant actors are involved. This could identify issues overlooked by this study, and could *rank* the importance of these issues – compensating the biggest limitation of applying the *pluralistic theory of the firm*. Also, such a process can generate substantive and supported insight into the role of the government to address these, and possible additional, issues. Nevertheless, the recommendations below can be seen as an indication about the possible outcome of such a process. The recommendations can trigger EL&I, EBN and the industry to enter the debate. Surely, it indicates that by approaching the research domain from a *methodological interactionistic* and *pluralistic* perspective results in additional insights.

FACILITATE AND ENHANCE MORE OPTIMAL EXPLORATION ACTIVITIES

There are numerous ways to address the first residual issue, related to the low availability of plays for exploration and the sub-optimal exploration activities which were identified in 6.1.

The **first** recommendation to more actively facilitate upstream investments is to evaluate, and when needed adjust or optimize, the current fallow acreage structure.

Given the large potential of this measure (see 6.5), optimally conducting this measure can largely facilitate investments. Compared to the UK example, the Dutch fallow acreage is designed more *non-committal* but more importantly it was identified that it is *conducted* sub-optimal. Improving transparency and communication, or adjusting the measure to mitigate opportunistic behavior of parent licensees were identified as points for improvement. This will give firms more insight in the availability of fallow plays, increasing their interest to engage or remain active in the Netherlands.

A **second** recommendation stems from the sub-optimal design of the licensing, permitting and fallow acreage procedure with regard to *different activities*.

It is recommended to investigate the possibility for more tailored regimes for on-shore versus off-shore activities, mainly related to public resistance. It is also recommended to tailor these regimes for tough field activities. Options are *vertical* licensing, or different regimes for different types of projects. In addition to that, it must be investigated whether exploration rights can be de-coupled from production rights. This would largely increase the availability of plays. A declining sector asks for a paradigm shift, and careful re-considerations of the present boundaries of the changed playing field (also see Worldbank, 2009 and Hunter, 2009).

A **third** recommendation is to also apply the marginal investment allowance on-shore. A **fourth** recommendation is to investigate and consider the possibilities for *sole-risk* operations of EBN. A **fifth** recommendation is to consider *promote licenses* for in-popular acreage (see appendix 8). A **sixth** recommendation is to evaluate the availability of proper information on the sub-surface. Possibly, EBN can – together with e.g. TNO – more actively distribute information to firms, lowering the knowledge barrier.

FACILITATE AND ENHANCE MORE OPTIMAL PRODUCTION ACTIVITIES

To valorize the potential upside of tail-end production, to prevent that operators are *sitting on assets*, to reduce opex – and with that indirectly extend the *viable recovery period* – and to increase the availability of production plays, the following measures can be considered to facilitate and enhance a more optimal level of production activities.

A **seventh** recommendation to more actively facilitate investments is to introduce *Stewardship* according to UK example (see appendix 8).

Stewardship was introduced in the UK with the aim to realize the full economic potential of the brown-fields (the fields which already being produced), by incentivizing maximum investments and production efficiency. In essence, good *Stewardship* comes down to two key factors: (i) that asset owners consistently do the right things to identify and then exploit opportunities, and that (ii) assets are in the hands of those with the collective will, behaviors and resources to achieve this (DECC, 2012 see appendix 8). Stewardship can be expected to enhance tail-end production, reduce opex, create a sense of urgency to unlock contingent resources, and to increases operational efficiency. Also, this gives parties more transparency and possibilities for learning-by-doing by benchmarking their performance with peers. Most importantly, this prevents the situation that parties are *sitting on assets.*

An **eight** recommendation is to integrate innovation-contracts or other existing JIP's to new business-models such as gas-to-wire and gas-to-liquids.

This will stimulate companies to build or share knowledge, or to find budget for their innovations. Also, the *working-program* requirements can be considered to become more flexible to be adapted by such innovations. Ultimately, this will not only support innovative firms, but also stimulate innovation of less-active firms, or at least make them aware of technical possibilities. This initiative can potentially be coupled with stewardship, as this will largely reward innovative companies.

A **ninth** recommendation is to consider a special fiscal regime for applying certain technologies, to stimulate activities in special projects (e.g. tail-end equipment or fracking equipment).

STIMULATE OPEX-REDUCTION

The increasing opex was seen as an increasing barrier for (extending existing or new) investments. Opex has to be reduced by the firms, and it is questionable what the role of the government must be to reduce this barrier. Nevertheless some considerations can be made.

Opex is indirectly reduced by applying stewardship, as this would replace inefficient operators with a high opex, for more efficient operator when this is possible. As EBN covers 40% of the expenses, reducing opex can be seen as a problem for the government. Moreover, Stewardship would increase operational insight and stimulate learning-by-doing based by its benchmarks. This can point operators at possibilities for reduction, compared with their peers.

A **tenth** recommendation is to facilitate opex reduction by facilitate possibilities for joint-bargaining at suppliers and resource-sharing (especially off-shore). Also, allocative efficiency with regard to planning and purchasing supplies can be optimized by valorizing EBN's "*eagle-eye"* capabilities.

LOWER REGULATORY BURDENS AND PUBLIC RESISTANCE ON-SHORE

An **eleventh** recommendation is to evaluate the burdens-and-benefits of the current on-shore regulatory regime, adding to the needs of on-shore activities in a changing context.

In the changing context, with higher public resistance, and prospects for high gains of shale-gas developments, EL&I is recommended to re-think the current regulatory design of licensing and permitting (also see the second recommendation). The involvement of many lower governments for permitting can possibly be streamlined by establishing *one central agency* for on-shore E&P activities. Also, it must be questioned whether it is necessary to request permits – and with that engage with stakeholders – for projects which only comprise a feasibility study. This can possibly be combined with *Promote licenses* (see the fifth recommendation). For some projects, even the *Rijkscoordinatie-regeling* might be a suitable option for consideration.

A **twelfth** recommendation is to actively be involved in stakeholder engagement, as already pointed out in other studies and recommended by the platform (see Pikaar, 2011).

MITIGATE THE SHADOW OF DECOMMISSIONING FOR OFF-SHORE INFRASTRUCTURE

As indicated in 6.1.3, the suppliers of infrastructure are powerful, negatively contributing the attractiveness of exploration and production activities and investments off-shore. It is expected that, without efforts from the industry and government, many prospects will lose their primary tie-in within a few years. Also, the owners and operators of infrastructure can behave strategically by setting the (unregulated) tariffs. Although EBN has ownership in the transmission lines, many other pipelines and platform – required to process and transport produced gas – are not regulated for required *third party access.* Although additional research can provide more insight in this issue, some considerations are recommended to increase the attractiveness (and *window of opportunity*) of exploration-, stranded- and tough off-shore engagement.

The **thirteenth** recommendation suggests exploring the possibilities of government involvement in off-shore infrastructure.

There are multiple degrees of freedom for government involvement: nationalization (not recommended), increase ownership of EBN by buying equity in the infrastructure, or regulated third-party access conditions and tariffs.

A **fourteenth** recommendation can lower the *shadow of decommissioning* to some extent without explicit government involvement. This however required high public-private and private cooperation. A special role for EBN can be seen to establish a long-term technology strategy, addressing an optimal utilization of off-shore infrastructure (according to Norwegian OG21 example, or the UK PILOT example).

Such a measure was established by the UK PILOT example. This recommendation cannot be seen separate from the recommendations to establish a more optimal and active regulatory regime (9.1). This again underlines the importance to establish a sound *process* aimed to develop a "Dutch Pilot." Initiatives like these can be implemented with support from the industry by such a process (as the UK example has proven), benefitting both the industry and the government.

Peer-pressure (from out e.g. NOGEPA) to increase transparency on tariffs and scheduled decommissioning, or available equity in infrastructure, is a **fifteenth** recommendation which can be deployed rather easily as a temporary measure to reduce (or at least clarify) the *shadow of decommissioning*.

ACTIVELY APPROACH NEW FIRMS, AND FACILITATE CAPABILITY-MAXIMIZATION OF PRESENT FIRMS

As identified in 6.3, the **sixteenth** recommendation is to actively approach new firms and increase information distribution about availability of (fallow) plays and operational benchmarks (combined with stewardship).

Direct or *aimed* approaching firms with certain resources and capabilities to perform required activities (tail-end, tough projects) can be done in numerous ways, ranging from road-shows to transparent information

about the Dutch upstream on a website. This can particularly be aimed at firms which are not yet involved on the Dutch acreage.

CONSIDER THE POSSIBLE CONTRIBUTIONS OF GASTERRA, AND CONTINUE THE SMALL-FIELDS-POLICY

Section 6.2 pointed out the value of the small-fields policy (SFP), and the role of GasTerra. Although GasTerra's conditions need to be *market-conform*, it a **seventeenth** recommendation is to explore how GasTerra can contribute to residual sales-issues.

The 17 recommendations are of different nature and all require different trade-offs about their viability, but mostly about the optimal role of the government or EBN. Hopefully this research has provided insights for EL&I to amend the *gas roundabout* policy and aim for a more active regulatory regime which actively facilitates investments, together with the industry and EBN.

9.3 RECOMMENDATIONS FOR FURTHER RESEARCH

During this research, some knowledge gaps were identified. These knowledge gaps were not filled by this research, therefore it is recommended to other scholars to address the following six topics related to this research problem or research approach.

1. The contribution of the Dutch gas (roundabout) policy to the development of a physical and virtual hub

Paragraph 2.4 only *assumed* the contribution of the *existence* gas roundabout policy to the movement towards a midstream (physical and economical) structure of a gas *hub.* This research pointed out that the existence of the gas roundabout policy is independent from the existence of policy measures to facilitate upstream investments. It can be questioned whether this is also the case for the midstream part of the value chain. This question can be generalized to scientific knowledge gap: How can this policy be unraveled from other developments (e.g. liberalization, private efforts by e.g. APX-ENDEX for a virtual hub and Gasunie for the physical hub)?

2. Government involvement in private infrastructures

This study indicated that privately-owner off-shore infrastructure can be associated with opportunistic behavior of owners. It is assumed that the presence of EBN (a state-owned firm), regulating tariffs and access, increasing transparency, or even nationalization of this infrastructure (increase equity EBN or EL&I) might have a positive contribution on the perception of the *shadow of decommissioning* and uncertainty with regard to tariffs and access. This well-defined issue can be addressed by other scholars, for example by applying the TCE approach. Should the government be involved in private infrastructures? What would be the effect of the different alternatives (increase equity, regulate tariffs and access, increase transparency, do nothing) on the infrastructural uncertainty, and with that possible investment hold-ups?

3. Hybrid policies and markets in a transition phase: hampering or securing investments?

As elaborated upon in chapter 6.2, the current market situation for selling natural gas is *redundant* or hybrid. Parties can benefit from the small-fields policy, or sell their gas to the exchange. Both modes of governance take away price- and volume uncertainty. It can be questioned why government involvement is still necessary (by means of the SFP), as the conditions of GasTerra are market-conform. Or, does the existence of the SFP hamper the development of a liquid and well-functioning exchange? The opposite could also be the case, as suggested by 7.3. Do hybrid markets facilitate upstream investments during a transition phase? What are the long-term effects?

4. Applicability of TCE: a trade-off between behavioral and environmental uncertainty?

This study identified that TCE can be applied for upstream natural gas investments, but that (in the Dutch case) the explaining capabilities of the theories are limited relative to other elements such as POS, EMV and public resistance. Other researchers showed that TCE can have explaining power in other cases (Hubbard and Weiner,

1991; Neuman and Hirschhausen, 2006 and many others). How can this be explained? The explanation of this study lies in the trade-off between behavioral uncertainty (as main purpose of TCE) and environmental uncertainty. The relative weight of transaction costs, and considerations on governance structures and safeguarded, needs to be positioned against other drivers for investments in other research domains.

5. Applicability of the *pluralistic theory of the firm* or the *integrated policy framework*

Lastly, this study also challenges other scholars to challenge, expand or improve the developed theoretical contributions: the *pluralistic theory of the firm* for its applicability to address issues in comparable research domains (e.g. refinery industry) or the *integrated policy framework* in for other policies (e.g. security of supply). The framework can be improved by application when also theories regarding actor-behavior in networks, and decision making theories by the policy maker are included.

6. Designing A Dutch Long-Term strategy for upstream exploration and production: combining process- and institutional design

This would be the next step for direct follow-up on this study, as recommended in sections 9.1 and 9.2. How can the decision-making process be designed to include more *process managerial* aspects? Which institutions (e.g. to govern Stewardship) need to be designed for the “Dutch Pilot”, and how can this be done? What is the role of the government?

10. REFLECTION

This final part will reflect on the research approach (10.1), the research results (10.2) and include a brief personal reflection (10.3).

10.1 REFLECTION ON THE RESEARCH APPROACH

During the execution time of this research, the research approach was adjusted several times. Initially, the research plan aimed to objectively describe the entire natural gas value chain, and determine the effect of the gas roundabout policy to the most important technical, institutional and economic structures. Thereafter, the initial plan was to determine the attractiveness of the Dutch upstream investment climate before and after the implementation of the gas roundabout policy. Empirical insights must be derived from literature, reports and interviews. However, after some time (+/- 3 months) it appeared that this approach was insufficient to deliver a significant contribution to the practical and scientific knowledge gaps. Several drivers were the reason for adjusting the initial research plan. First of all, it was challenging to describe the research domain objectively but comprehensively. Describing the research domain along a framework and theory was found to be more scientifically responsible, and suitable to fill the knowledge gaps. Secondly, it was challenging to unravel the gas roundabout policy from other developments, such as liberalization and private efforts to develop the gas roundabout. Therefore, it was decided that an extensive theoretical body would be required before the research domain could be mapped and analyzed. In addition to that, the gas roundabout policy required a thorough analysis itself. This urged the need to both analyze the policy, and afterwards determine the contribution of the policy to the attractiveness of the Dutch upstream investment climate. Initially, the aim was to determine the *effects* of the gas roundabout policy on the upstream investment climate, but due to the nature of the policy, another approach was required. This resulted in an adjustment of the research plan after the midterm meeting. Also, it was stressed that a clear distinction between theory and empirics was necessary to scientifically approach the research problem. This adjustment resulted in the research approach which eventually emerged into this thesis.

This study is a-typical in many forms. Firstly, because it comprises of two theoretical bodies and two empirical bodies. In regular research approaches, only one theoretical body and empirical body are involved. Separating *policy* theories and empirics from *economical and institutional* theories and empirics was inevitable as there was no *integrated policy framework* yet. Eventually, the synthesis part of this thesis properly linked both parts. Future research can apply this *integrated policy framework,* to start with one theoretical part comprising both policy analysis and research domain analysis. Another a-typical character of this research is in the comprehensiveness. Single theories (e.g. TCE) were described, analyzed and reflected upon. The limitations of these theories to answer the research question individually urged the need to combine these theories into the *pluralistic theory of the firm.* In turn, this *pluralistic theory of the firm* was applied and reflection upon. The limitations of this developed theory were addressed, and *integrated* with the policy analysis theories. Regular theses would probably only conduct one of these steps, or start from out an *integrated policy framework.* The different phases in this thesis therefore also reflect the different phases of research which were conducted: (i) exploring, identifying and describing current theories, their applicability and limitations, (ii) developing new theoretical bodies and frameworks, (iii) applying these new theoretical bodies, and again reflect upon these developed theoretical bodies. The first two steps were conducted separately for PART I and PART II, and the PART III integrated two theoretical bodies, adding to their theoretical needs. These seem very logical and sequential steps, but the actual research process was very iterative and it took some time before this final structure could be established. This having said, the final research approach can be reflected upon.

A first aspect of the research approach comprised the policy analysis theory and application of PART I. Initially, it was aimed to reconstruct the policy theory, according to Hoogerwerf (1998). This appeared to be a useless exercise, when it became clear that there are multiple approaches to analyze policy. The research approach distinguished between the *process* and *project* approach to policy analysis. This seemed to be a useful

distinction to place the policy in the right perspective. After it was decided to approach the gas roundabout policy from a process approach, it was challenging to analyze and evaluate the policy according to the theoretical guidelines by De Bruijn and Ten Heuvelhof (2008). These criteria are mainly aimed at a *classical process environment*, but of some use for this research as this resulted in the policy evaluation of section 4.3. Most importantly, the *process*-approach provided useful guidelines to characterize a research domain and problem (see table 3). However, the criteria of De Bruijn and Ten Heuvelhof (2008) do not provide guidelines how to actually analyze policy. The *tracing* of policy objectives and instruments was suggested by supervisor Martijn Groenleer. This appeared to be very useful, and complementary to the theory of De Bruijn and Ten Heuvelhof. The *integrated policy framework* therefore also suggests to combine or extend the theoretical *process*-approach criteria with *tracing* for improved policy analysis (see 7.4). Other limitations of the applied policy analysis theory were stressed in section 4.5, and used to develop the *integrated policy framework.* With that, this study added to the current theoretical insights and can be of use for future research. In addition to that, this thesis placed the concepts of *framing* and *tagging* central. As the amount of literature addressing this concept is not well developed, it was useful to distinguish between different modes of *framing* (see box 2). This allowed this research to give these important concepts an elementary position, and adds to the insight about *framing* for future research.

For the empirical insights on the gas roundabout policy, all policy publications (see appendix 5) were available for the desk-study. Because the scope and content of the policy developed over the years, a common denominator had to be found about the objectives and instruments which were assessed. It was decided to use the most recent, and most extensive, publication on the gas roundabout policy as main reference point (EL&I, 2011). The process approach allowed emphasizing on this dynamic development of the policy, which was welcome. By reading and re-reading all policy publications, this thesis provided a comprehensive insight into the relation between the gas roundabout policy and upstream investments.

For additional empirical insights, interviews with policy makers were conducted. This was interesting, but also important to make sure that this research understood the essence of the gas roundabout policy thoroughly. By organizing three meetings with EL&I-officials, this research attempted to incorporate the viewpoint of EL&I properly. Still there are some important considerations which need to be stressed. Firstly, the interviewed officials were related merely to the gas roundabout policy, and not especially to the Dutch upstream investment climate. Interviewing other officials could have resulted in additional nuances. Secondly, analyzing policy as outsider is challenging as policy making and interaction between the government and the industry is more extensively than documented in e.g. the *gas hub consultative platform* (EL&I, 2010). First of all, the trade-offs made within EL&I for certain objectives, instruments and processes are not explicitly documented in the policy publications. Other policy domains, ministerial priorities, political influences or other ministerial obligations also play an important role. In addition to that, EL&I also interacts with the industry bilaterally and in other *arenas*. Merely analyzing and evaluating e.g. the *gas hub consultative platform* does not comprehensively represent the picture of policy making, trade-offs and interaction. A limited fair *platform* does not mean a limited fair interaction of EL&I with the industry overall. Therefore it is stressed by the *integrated policy framework,* that this might not be overlooked. The researcher is well aware that his viewpoint is limited because of constraints related to *implicit* policy choices, overlooked interrelations with other policy domains, time, experience, resources and other interactions of the policy maker with the industry. Nevertheless, the researcher is convinced that the policy analysis and evaluation in this thesis are closely related to the actual world or policy making.

A second aspect of the research approach comprises the scientific, institutional and economic theories and application of these theories in PART II. In the beginning of the research process, it was very challenging to determine which theories could be applicable to determine the contribution of the gas roundabout policy to the attractiveness of the upstream investment climate. This was challenging because the gas roundabout policy comprise many different *contributing factors*. These ranged from a covenant, a fiscal measure, additional pipelines (the *physical hub*) and a changing market structure (the *virtual hub*). In addition to that, this was

challenging because *attractiveness* is a normative criteria, depending on the *perception* of different firms. Developing a structured approach to examine all these different elements – required to actually answer the research question – was the most challenging part of the research process. A quick scan about different theories – especially *theories of the firm* – indicated that there were many possible approaches. The key was to (i) identify the most *relevant* approaches, and possibly (ii) combine these approaches into one structural theory. As the research had no experience in doing so, and no clue where to begin, the support from Professor John Groenewegen was very welcome to structure this approach. Three very general and different articles became the *pillars* of this scientific process: Ostrom (2005) on the difference between frameworks, theories and models; Groenewegen et al. (2000) on the different methodologies; and Groenewegen and Vromen (1996) on theoretical pluralism. By reading and re-reading these articles, and by discussing these articles multiple times, the essence and relation of these three almost philosophical perspectives became clear. These articles allowed the development of the two most important scientific contributions of this thesis: the *methodological interactionistic framework* and the *pluralistic theory of the firm.* By developing this framework, all the different elements and relations among these elements could be linked. After that, theories could be identified which could make precise assumptions about these elements and relations. This approach, based on the three *pillars* is generally applicable and can be recommended to future researchers. By emphasizing on the limitations of the three identified theories (Porter, TCE and RBV), the need and added value of *combining* these theories into one *pluralistic* theory was stressed (5.5.1.5). The added value and limitations of the developed *pluralistic theory of the firm* were stressed, to indicate that also such a *pluralistic* theory is far from perfect (5.6). Still, this theory provided a structures research approach to enter the empirical phase of research, chapter 6.

By conducting interviews with senior managers or country directors of 6 different operators, the most important variables from the theories could be operationalized. All interviews comprised questions on the firm's resources and capabilities, the sales transaction, and the five forces of Porter. Apart from these interviews, also an extensive desk-study was performed to operationalize the *pluralistic theory of the firm.* The most important limitation of this research approach is that insights from the interviews must be generalized or aggregated. The interviewed parties all have – slightly or largely – different problem perceptions. Still, the researcher beliefs that (i) the most important hurdles for investments and (ii) the contribution of the gas roundabout policy to upstream investments, is explored for representatively and properly. This part of the research could be improved by conducting a quantitative survey among *all* operators, or interviewing more parties. Time and resource constrains had to decide the researcher to leave this up for future research. Face-to-face interviews also result in nice anecdotes and most importantly, it gives the opportunity to thoroughly understand the answers of the interviewed parties. Concluding, the researcher is very satisfied about the structure and results of the research approach conducted for PART II, although the limitations of the approach were also stressed (6.6).

PART III illustrated the added value of separating the research in two previous PARTS. Insights from the research domain (PART II, e.g. the difference between small and large firms) could explain certain elements of the policy (PART I, e.g. the involvement of parties and the subsequent problem perceptions). Ultimately, the limitations of both PARTS were summarized, and resulted in the development of the *integrated policy framework* (7.4).

In general, the research approach resulted in actively *working with theories*. This comprises to apply theories, indicate the limitations of theories, develop theories, and indicated the limitations of the developed theories. From a scientific perspective, this research approach contributed to the theoretical body of knowledge as indicated above. The research approach did not only support to answer the research question of this study, it can also contribute to future research by means of the *integrated policy framework* for future policy analysis, by means of the *pluralistic theory of the firm* for future analysis of upstream investments and policy, and by means of the structures approach to develop frameworks, theories and models. Finally, this research also indicated that the theories of Porter, TCE and RBV can be operationalized thoroughly for a rather complex research domain quite practically. This might encourage future researchers to also apply these theories, or find

where these theories can be improved of combined with other *theories of the firm*. Still, future research is recommended to apply and further develop the *integrated policy framework.*

10.2 REFLECTION ON THE RESEARCH RESULTS

How valid are the results and conclusions of this research? This will be reflected upon for the conclusions of PART I and PART II.

In PART I, it was concluded that the gas roundabout policy can best be approached from a *process*-perspective. This is, given the criteria based on table 3, absolutely the case. Analyzing the gas roundabout policy as a *project,* as was done by e.g. the CoA (2012), results in an incomplete and simplified picture of the reality. The reaction of the minister of EL&I on this approach is illustrative (CoA, 2012:25).

The second conclusion of PART I was that (i) the gas roundabout policy is mainly a *frame*, (i) the existence of the gas roundabout policy does not contribute to the existence of the suggested upstream objectives and instruments, and (iii) the decision-making process was limitedly fair. Precisely, these three conclusions can be drawn but they need some *nuance* for validity. Firstly, the *frame* can be recognized by EL&I, also when looking at the policy publications (appendix 5). It can be expected that EL&I will mainly emphasize on the positive elements of *policy-framing* and *issue-framing,* as described in 4.2.4. However, this *framing* also has pitfalls as illustrated in 7.1.2. The main pitfall – a frame needs to be succeeded by an active decision-making process – was partly mitigated by establishing the *gas hub consultative platform.* Secondly, the *distinctness* of the policy objectives and instruments was explained by the interrelatedness of the gas roundabout policy with other policy domains, and the fact that the gas roundabout policy was seen as a *brown field project.* It is logically that these initiatives are *coupled* to the gas roundabout policy, but it probably goes too far to actually present these instruments as *achievements* of the gas roundabout policy. Bottom line is that both the *policy-frame* and the *issue-framed* objectives and instruments do not address identified challenges for future upstream investments. Thirdly, the limited fairness of the decision-making process was nuanced. Other policy-domains and arenas can also contribute to substance and support for EL&I about upstream investments. Because of these other interactions of policy makers with the industry that there is, apparently, no *sense of urgency* to actively establish a decision-making process to address the Dutch upstream investment climate. The (*limitedly fair*) decision-making process concerning the gas roundabout has room for improvement, as stressed in 4.4, 8.1 and 9.1. However, other arenas (e.g. NOGEPA-interaction, bi-lateral contacts) might be sufficient for the government to generate substance, and for the industry to put forward their issues. A last nuance is that it is challenging for an outsider to thoroughly judge a policy, including all the politics and interrelatedness with other policy domains. Still, the researcher beliefs that within the scope of this thesis, it gave a solid representation and analysis of the gas roundabout policy in relation with upstream investments.

How valid are the results of PART II? It was concluded that the contribution of the gas roundabout policy to actively facilitating investments is positive, but not sufficient to realize the desired production-levels (30/30 objective) and that many residual issues remain unaddressed. In 6.6, a reflection on the applying the *pluralistic theory of the firm* was already provided. Purely emphasizing on the conclusions, some remarks can be made.

Firstly, the contribution of the gas roundabout policy was addressed by emphasizing on the *direct and indirect contributing factors*. Interviews with operators validated how these factors contribute to their investments. The validity of the benchmark of *Fallow Acreage* and the *Adjustment of the Mining Act* with the *UK Fallow Initiative* depends upon the assumptions of this benchmark (see appendix 6). These assumptions can be seen as valid, and the research also *nuanced* the contribution of *Fallow Acreage* and the *Adjustment of the Mining Act* by stating that this potential contribution depends upon the deployment of these instruments. When the Dutch *Fallow Acreage* regime would be equal to that of the UK, it has to potential to add 96 bcm over the period 2010-2030. The contribution of the Marginal Investment Allowance was based on calculations supporting this measure in the *Staatscourant.* These calculations were validated by a business-controller of EBN. The most uncertain is the contribution of the Innovation Contracts. No benchmark possibilities or

empirical evidence was present, although the assumptions to determine the contribution seem reasonable according to interviews with operators. The contribution of the indirect factors and the small-fields policy was extensively discussed with operators and commercial advisors within EBN. This *expert validation* therefore substantiates the assumptions made in chapter 6.2.

Most challenging are the *normative assumptions* of the operators about the future challenges of the Dutch upstream investment climate. As mentioned in the previous chapter, only 6 (of the total 16) operators were interviewed. This limitation is also stressed in 7.4 and in the recommendations of this thesis. The researcher beliefs that the conclusions drawn in PART II correspond with developments and drivers for investment-behavior in the real world. Also, future research was recommended to further investigate some of the identified knowledge gaps, and it was stressed that an extensive (quantitative) survey might further nuance the *normative* values which were used to operationalize the *pluralistic theory of the firm* and the exploration of challenges for the future.

10.3 PERSONAL REFLECTION

Briefly, I can reflect upon my first actual scientific research from a personal perspective. It was a big challenge to conduct a research in an industry with which I was not familiar, applying theories I had not heard of before. Still, by reading and re-reading numerous literature, writing and re-writing, structuring and re-structuring, talking and listening to operators, policy-makers, supervisors and EBN'ers allowed me to deliver a piece of work which *satisfies* my personal objectives within this research process. It was challenging to place different opinions of interviewees and supervisors in perspective, it was challenging to thoroughly understand the theories I worked with and it was challenging to structure and link policy to investment behavior. By making explicit choices and trade-offs, and by careful and hard work I became better in doing so. The most important personal learning's relate to my interview techniques and strategies, the structuring of complex problems, and making explicit choices. In times of chaos, going back to the basic question and research problem proved to be helpful, and talking about the research with external people assisted me in structuring the problem for myself. This research process was the most educational experience with regard to my studies of the past years, and I greatly enjoyed it most of the time.

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LIST OF ABBREVIATIONS

ACQ	– Annual Contracted Quantity
AER	– Dutch Energy Council, or Algemene Energie Raad
BAU	– Business as Usual
BCM	– Billion Cubic Meter of natural gas
CAPEX	– Capital Expenditures
DCQ	– Daily Contracted Quantity
DHC	– Dry Hole Costs
DSO	– Distribution System Operator
EBN	– EBN B.V., formerly Energie Beheer Nederland B.V.
EDGaR	– Energy Delta Gas and Research knowledge institute
EL&I	– Dutch Ministry of Economic Affairs, Agriculture and Innovation (successor of EZ in 2010 with Dutch cabinet Rutte I)
EMV	– Expected Monetary Value (NPVsuccess/POS + NPVfailure/(1-POS))
EZ	– Dutch Ministry of Economic Affairs (succeeded by EL&I)
GIIP	– Gas Initially In Place
GTS	– Gas Transport Services, the Dutch TSO
JOA	– Joint Operating Agreement
LNG	– Liquified Natural Gas
NCE	– Neo-classical Economics
NLOG	– Dutch Oil and Gas Portal
NMa	– Dutch antitrust authority, or Nederlandse Mededingings Autoriteit (overarching department for antitrust, DTe formerly was energy authority)
NIE	– New-Institutional Economics
NOGEPA	– Dutch Association of Oil and Gas Exploration and Production Companies
NPV	– Net Present Value
OPEX	– Operational Expenditures
OTC	– Over The Counter
OvS	– Agreement of Cooperation, or Overeenkomst van Samenwerking
POS	– Possibility Of Success, likelihood that natural gas will be found by an exploration drilling.
R&D	– Research and Development
RBV	– Resource Based View
RVIR	– Risked Value to Investment Ratio ((POS*NPV-(1-POS)*DHC)/(POS*CAPEX+(1-POS)*DHC.
SG	– Secretary General
SFP	– Small Fields Policy
TSO	– Transmission System Operator
TTF	– Title Transfer Facility, the Dutch natural gas *hub* operated by GTS (physically) and virtually by APX-ENDEX (exchange spot-market).
TCE	– Transaction Costs Economics