

Ports in transition

Research and case study - Bahía de La Habana, Cuba



W.W.J. Neisingh

Delft University of Technology
Master Watermanagement
Additional thesis

4101839

w.w.j.neisingh@student.tudelft.nl

Supervisors

Prof. dr. ir. T. Vellinga
Ports & Waterways

Ir. drs. J.G. Verlaan
Construction Management
& Engineering

The photograph on the cover is taken by myself in May 2016 on my field trip to Cuba, which marked the start of my thesis. To me, it has been an inspiration due to its ability to depict the current situation in such a compendious, comprehensible manner. It illustrates the bay of Havana, facing the Sierra Maestra pier, adjacent to Havana Vieja; the historical center of the city. I was intrigued by the sharp contrast between the lush appearance of foreign visitors with their antique sailing vessel seemingly superseding the surrounding context of local inhabitants, sauntering in their own neighborhood while overlooking a beautiful natural bay marked by the heavy industry and pitch black fumes as remainders of a tumultuous 20th century. In its simplicity, it almost reveals the inevitable change to come.

This thesis is written as Additional Thesis as part of my master Watermanagement at Delft University of Technology. I am truly grateful for the freedom and support that I received from the department and especially my supervisors T. Vellinga, J.G. Verlaan and P. Taneja.

Special thanks goes to the students and staff of the European Master of Urbanism (EMU), Professor Córdova Lopez and the students from CUJAE, the Royal Dutch Embassy in Havana, the Lamminga Fund, Universiteitsfonds Delft and DIMI (Delft Deltas, Infrastructures & Mobility Initiative).

Wouter Neisingh

Summary

Worldwide, sea ports are subject to an ongoing competition in terms of global economy. They face the challenge to either keep up with this trend by adapting to the increasing requirements (e.g. port facilities, infrastructure, handling capacity and speed, etc.) or to accept a loss in market share. Although the latter is far from preferable, some ports are inapt for this and are left no choice and as a result deteriorate and (eventually) can be left abandoned.

The cause of this partially lies in the way that ports traditionally are developed. Usually, the traditional design process merely takes economic and governmental aspects into account. Moreover this linear and deterministic design process leads to rigid designs that include little room for flexibility and future adaptations. Constraints with this traditional port development can be found among the following aspects.

- Location
- Flexibility
- Slow design process
- Mixed interest of decision making parties
- Method of decision
- Method of investment
- Risk management
- Social and environmental impact.
- Abandoned city ports serve as a paradigm of this development.

Besides the aforementioned economical incentives to alter the traditional port development, other external incentives include the UN Sustainable Developments goals, and (inter)national policies.

City ports – like the port of Havana – serve as a paradigm for this type of development. In many cities where the former industrial port started to coincide with the remaining public spaces of the city, the port has to transform. Although examples of such transformations are available, there seems to be no common clear opinion on how this transition should be organized. Therefore this thesis aspires to contribute to a better understanding of these processes by developing a framework for a port in transition, in this case Havana.

Due to a tumultuous 20th century and recent development in terms of politics, economy and trade, the activity of the port of Havana is shifting towards the port of Mariel, which is appointed as Special Development Zone. Therefore the government appointed a work group that is in charge of the transition of the bay of Havana. Although the government does not release a lot of information regarding their intentions for the bay, it can be concluded ((GTE-BH), 2015, (PID-BH), 2014) that the goal is to use the port for the tourist industry while improving the quality of the water in the bay to safe swimming water standards.

Table of contents

| Section | Page |
|---|------|
| Preface | iii |
| Summary | iv |
| Table of contents | vii |
| 1. Introduction | 1 |
| 1.1. Problem statement | 1 |
| 1.1.1. Port development | 1 |
| 1.1.2. Havana, Cuba | 2 |
| 1.2. Objective | 4 |
| 2. Research methodology | 6 |
| 2.1. Introduction | 6 |
| 2.2. Research question | 6 |
| 2.3. Research plan | 6 |
| 2.3.1. Part one: port development | 7 |
| 2.3.2. Part two: the case of Havana, Cuba | 7 |
| 2.4. Result | 9 |
| 2.5. Evaluation | 9 |
| 2.6. Reader guide | 9 |
| Part one - Research | |
| 3. Traditional port planning | 11 |
| 3.1. Introduction | 11 |
| 3.2. The traditional port | 11 |
| 3.3. Traditional port development | 11 |
| 3.4. Problems with traditional port planning | 13 |
| 3.5. Conclusion | 14 |
| 4. Incentive for a different port development | 16 |
| 4.1. Introduction | 16 |
| 4.2. United Nations Sustainable Development Goals | 16 |
| 4.3. Global economy | 17 |
| 5. Alternative Port Planning Methods | 20 |
| 5.1. Introduction | 20 |
| 5.2. Definition of the Sustainable port | 20 |
| 5.3. Sustainable design philosophies | 21 |
| 5.4. Alternative frameworks | 21 |
| 5.5. Previously Developed Land (PDL) | 24 |

| | |
|---------------------------------------|----|
| 5.6. Conclusion | 24 |
| 6. Framework for a port in transition | 28 |
| 6.1. Introduction | 28 |
| 6.2. Ideology of the framework | 28 |
| 6.3. Guidelines | 29 |
| 6.4. Scenarios | 30 |
| 6.5. Conclusion | 31 |

Part two - Case study

| | |
|--|----|
| 7. Introduction | 33 |
| 7.1. The case study | 33 |
| 7.2. The Marina and Terminal project | 33 |
| 7.3. The governmental workgroup | 35 |
| 8. Step 1: Understand the System | 37 |
| 8.1. Introduction | 37 |
| 8.2. Scenarios | 37 |
| 8.3. Driving forces | 37 |
| 8.3.1. Climate change | 38 |
| 8.3.2. Politics | 39 |
| 8.4. Stakeholder analysis | 40 |
| 8.4.1. High priority stakeholders | 41 |
| 8.4.2. Other opposing parties | 42 |
| 8.4.3. Driving forces: climate change and politics | 42 |
| 8.5. Tourism analysis | 43 |
| 5.1 Numbers | 43 |
| 5.2. Assets of Cuba for tourism | 44 |
| 5.3. Environmental governance | 44 |
| 8.6. Cruise tourism | 44 |
| 8.6.1. Actors | 45 |
| 8.6.2. Infrastructure impacts | 46 |
| 8.6.3. Operational impacts | 46 |
| 8.6.4. Distribution impacts | 48 |
| 8.6.5. Use impacts | 48 |
| 8.6.6. Waste impacts | 49 |

| | |
|--|----|
| 8.7. Environmental analysis | 55 |
| 8.7.1. Definition | 55 |
| 8.7.2. Bad practices | 56 |
| 8.7.3 Good practices | 57 |
| 8.7.4. Results | 57 |
| 8.7.5 Nuance | 57 |
| 8.8. Climatology analysis | 58 |
| 8.8.9 Reference projects | 59 |
| 8.8.10 Additional analyses | 60 |
| 9. Step 2: Prioritize elements | 62 |
| 9.1. Introduction | 62 |
| 9.2. The elements | 62 |
| 10. Step 3: Define project must-haves and should-haves | 64 |
| 10.1. Introduction | 64 |
| 10.2. Goals | 64 |
| 10.3. Must-haves | 64 |
| 10.4. Should-haves | 65 |
| 11. Step 4: Develop alternative designs | 66 |
| 11.1. Introduction | 66 |
| 11.2. Reference project | 66 |
| 11.3. Design #1 | 67 |
| 11.4. Design #2 | 68 |
| 11.5. Design #3 | 69 |
| 11.6. Design #4 | 70 |
| 12. Step 5: Test the alternatives | 71 |
| 13. Step 6: Evaluate the alternatives | 72 |
| 13.1. Introduction | 72 |
| 13.2. Climate change | 72 |
| 13.3. Politics | 72 |
| 13.4. Reality | 73 |
| 14. Step 7: Create the final design | 74 |
| 14.1. Introduction | 74 |
| 14.2. Spatial outcome | 74 |
| 14.3. Criteria | 74 |

| | |
|--|----|
| 15. Evaluation of the framework | 76 |
| 15.1. Introduction | 76 |
| 15.2. Evaluation | 76 |
| 15.2.1. Design | 76 |
| 15.2.2. Framework | 76 |
| 16. Conclusion and recommendation | 79 |
| 16.1. Framework for a port in transition | 79 |
| 16.2. Case study in Havana, Cuba | 81 |
| 16.3. Recommendations | 81 |
| 17. References | 82 |

Appendices

| | |
|--|-----|
| A. Problems with traditional port planning | 87 |
| B. UN Sustainable Development Goals | 90 |
| C. Sustainable design philosophies | 106 |
| D. Previously Developed Land (PDL) | 112 |
| E. Framework for a port in transition | 117 |
| F. Driving forces | 119 |
| G. Stakeholder analysis | 126 |
| H. Tourism | 137 |
| I. Environmental analysis | 162 |
| J. Reference projects | 168 |
| K. Remaining elements | 172 |
| L. Project must-haves and should-haves | 178 |
| M. Design options | 180 |
| N. Figures | 186 |

1. Introduction

1. Problem statement

1.1 Port development

Worldwide, the global trade growth is driving continuous challenges between ports, cities, regions and countries (fig. 1.1). As a consequence, ports and port cities have grown significantly over the past decades and established themselves within the global economy. In order to prevent a loss of trade and the competitive position ports are urged to keep growing and developing since a majority of the world trade is seaborne (fig 1.2).

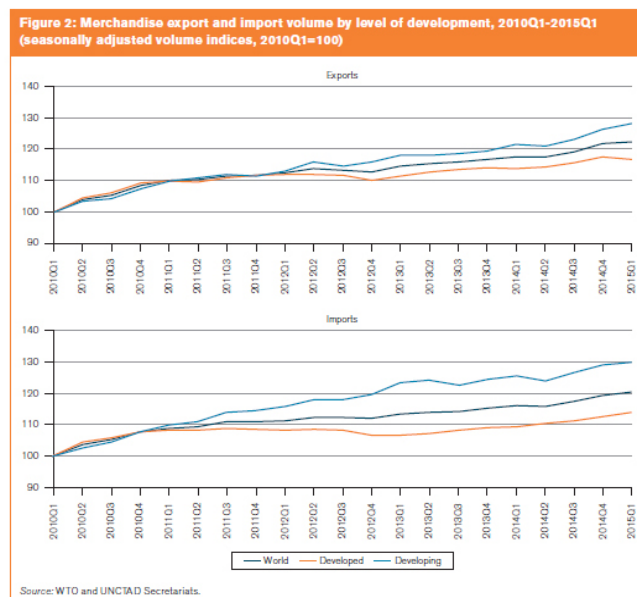


figure 1.1: World trade growth (World Bank, 2007a,b)

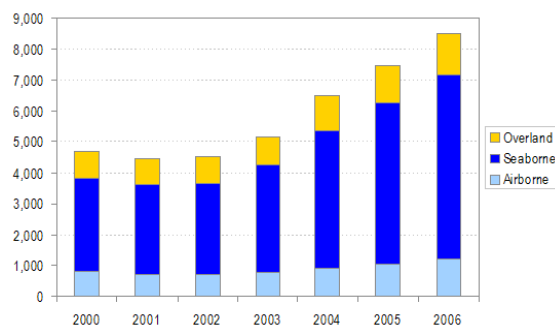


figure 1.2: Global modal split (Rodrigue, 2016)

In this dynamic industry, the development of the actual ports is a relatively conservative affair (Schipper et al., 2015). The increasing awareness of the Green Growth concept motivates port planners and policy makers to aim for a more sustainable port (PIANC, 2014). The goal is to avoid pitfalls due to short sighted port planning, including the accompanied economic and/or environmental loss. In order to present a feasible alternative for traditional port planning, sustainable ideologies and frameworks have been developed, such as Port of the Future, the Ecosystem-Based Design and the Integrated Sustainable Port Design (Schipper et al., 2015; Vrolijk, 2015; Zheng, 2015). Although this is an important step, the majority of research focuses on new or expanding ports, leaving out the category of ports in transition. The definition of ports in transition (or transition ports) used in this study is a port with a fundamental change in its main function (e.g. tourism, industry, production) due to certain national or international reasons (geopolitics, economics, environment, etc.). The terms transition and transformation will be used interchangeably.

Combined with improved insight in the flexibility of ports and brownfields (i.e. previously developed land (Leger et al., 2016)) this could form a base to better understand the opportunities and challenges that ports in transition are facing (Taneja, 2013).

1.2 Havana, Cuba

In January 2015, the United States of America enacted new travel and trade regulations for Cuba. This announcement appears as a prelude for the next turning point in Cuba's history. After a vibrant 20th century and 55 years of political and economic isolation due to the enforcement of the U.S.A. embargo, it seems that the Western world is preparing to restore diplomatic relations (Rathbone, 2015). Although the precise developments for Cuba's future remain uncertain, the transition is expected to lead to the restoration of international trade relations, growth of the private sector and an increasing number of international tourists (Roberts et al., 2016).

This transition will be of special interest to the region of Havana – as diplomatic, economic and touristic center. Currently three million tourist visit Cuba annually, but in merely two years this is expected to increase by another two to three million, especially due to the rise in

visitors from the United States of America (Romeu, 2008). To be able to fulfill this growing demand of the tourist market, Havana should transform its current tourism and infrastructure facilities.

However, being able to host tourists is not the only challenge Havana is facing. The city also wants to transform its pollution level. Because of the lack of sufficient public transportation, (illegal) taxi's and buses became a common way of transportation. In general, (except for China) barely any import in the car industry is currently allowed, leaving car owners no choice but maintaining their polluting remainders of the American or Soviet eras (Tiezzi, 2015). The result is that nearly every vehicle produces pitch-black fumes, which subsequently deteriorate the state of many vulnerable buildings. Heavy industry is still allowed at some locations in or around the city. The streets are full of garbage and the awareness among citizens of waste handling has a long way to go (Larsson, 2016).

With the influx of foreign capital a discrepancy will be created between state employees and private employees or entrepreneurs. The state income is limited at 25 CUC (convertible Peso, equivalent to €22), which also includes professions like doctor, university professors and engineers. Citizens who are private business owners, such as cab drivers private restaurants and tourist apartment rental manage to earn significantly higher wages. Since this is only allowed for the last 15-20 years, questions may rise how this will hold social economically once the U.S. embargo attenuates. If the country continues to be governed according to a Socialistic ideology this income inequality might lead to serious forms of segregation (Archibold, 2015).

In short, economic, environmental and social challenges lie ahead for the Cuba's capital. Also in the bay of Havana, near the heart of the city, these are ongoing challenges. The pollution comes both from industrial (petrochemical, construction, transportation) and domestic (sewage, sometimes mixed with drainage) sources, both locally produced or streaming into the bay through one of the rivers or streams. ((CUJAE), n.d.; (GTE-BH), 2015; Cubadebate, 2016) The state of pollution in the bay is monitored by the GTE-BH (Grupo de Trabajo Estatal de Bahía de la Habana). The GTEBH's goal is to create a bay area where the water quality allows for safe and comfortable recreational use including swimming. ((GTE-BH), 2015) This organization is led by government officials and has the ambition to reduce the pollution to safe swimming conditions (i.e.

25% of 1998 levels ((GTE-BH), 2015)) by cleaning up the body of water of the bay, reduce pollution, support reforestation, develop a scheme for environmental education and contribute to the development of the Bay of Havana through international collaboration (Grupo de Trabajo Estatal Bahía Habana, 2016). In practice this organization is mainly focusing on education of environmental topics and raising awareness about the situation in the bay of Havana. Furthermore they are allowed to impose tax legislation on companies that pollute the bay ((GTE-BH), 2015). This system, however, implies that the state-owned companies have to pay taxes to the state if they do not comply with the legislative targets. Hence the GTE-BH will only have little power as long as the state does not acknowledge the need for environmental protection in the bay area.

The city's natural bay has been used for industrial and commercial purposes in the past, but is not suitable for further economic development of the region of Havana. Therefore, the port of Mariel – 50 km west of Havana - has been designated as the Special Development Zone since 2009 (Mariel, 2016; Werlau, 2014) Two committees appointed directly by the government are currently developing both ports. The remainder of the bay area of Havana will be developed for residential, business and touristic purposes ((CUJAE), n.d.; (PID-BH), 2014).

In order to manage these kinds of large scale projects, design frameworks are common practice (Zheng, 2015). Among the port development industry, over the last years research and projects have been dedicated to improve the traditional design approaches. However, these projects mainly focused Greenfield ports while port transitions (i.e. brownfield ports) has been studied less often. In line with the previous research it would be an important step to investigate how these theories hold for port transitions.

2. Objective

The goal of this study is twofold: research and practice.

The research of the study investigates the possibilities to design a framework for transition ports in order to contribute to a more strategic and sustainable development of these type of ports, in particular the port of Havana. The term framework is defined as 'a structural plan or basis of a project' hence it functions as the strategic plan and roadmap for port

developers and other involved decision making parties ((Collins), 2016). Current literature on Brownfield port development does not always stress the importance of sustainability, thus for this study we will include this as integral part of the research. The outcome of the research is a proposal for a framework, which will be tested by the second part of the study.

The second part of the study takes a practical approach and aims to test the proposed theoretical framework by applying it to the port transition of the bay of Havana. Despite the intention to deliver a useful contribution to Havana's transformation, the main purpose of this thesis is educational. For this and other practical reasons many assumptions will be made which might not correspond to the reality. One of the most important assumptions comes in place at the necessity to test the framework's applicability. Cuba is at a turning point hence its future is exceptionally uncertain. In order to test if the framework is versatile enough to be applicable in reality, the framework will be tested under different (hypothetical) future scenarios. These scenarios will be developed and presented in this thesis and are based on research conducted by students of EMU (Canazzi et al., 2016).

2. Research methodology

6

1. Introduction

The research methodology will be explained in the upcoming chapter along the following paragraphs: research question (2.2), research plan (2.3), results (2.4) and evaluation (2.5).

2. Research question

Is the use of an alternative port development framework for port transitions feasible and preferable and can this contribute to a more sustainable transformation of the bay of Havana, Cuba?

3. Research plan

The research method can be schematically depicted as follows (fig 2.1). Appendix N contains a large version of this mindmap.

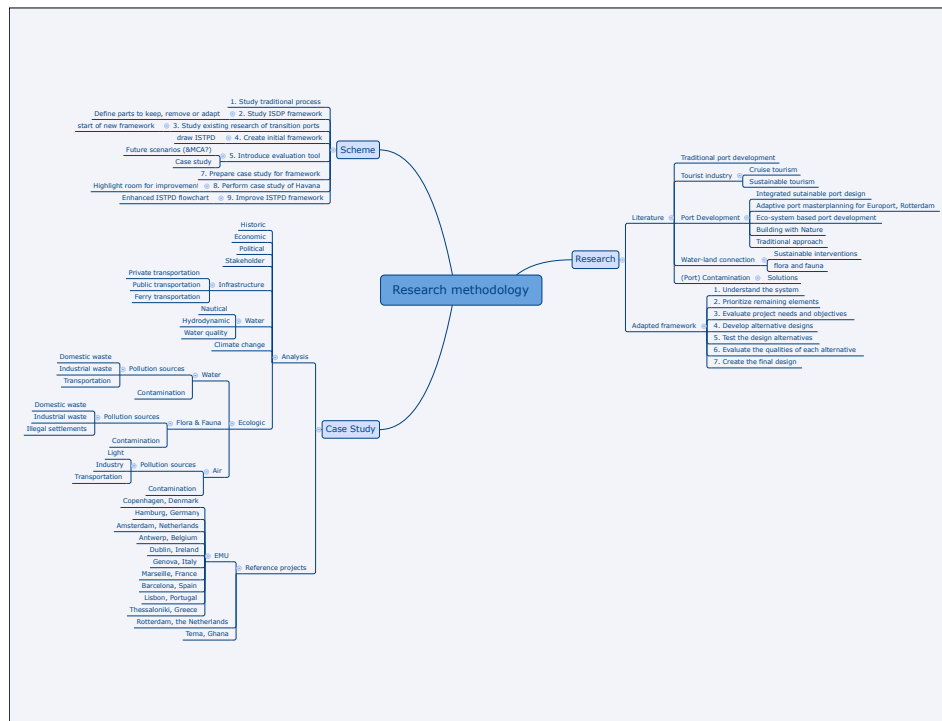


Figure 2.1 - Schematic view of the research methodology. (own work)

The thesis is divided in two parts. The first part is concerning the (theoretical) port development frameworks and will comprise of

the following chapters: traditional port development, sustainable port development, transition ports framework. The second part is concerning the case study of the port of Havana, Cuba and will mostly focus on a thorough analysis of the bay area of Havana in order to apply the developed framework. By doing so, more insight in the desirability and feasibility should be obtained.

3.1 Part one: port development

The chapters of the first part will be elaborated quickly.

In the first chapter, an investigation is made what traditional port development signifies and what challenges it is facing. It will aim to answer to the question why current port development methods do not function ideally.

In the second chapter the focus is to understand why and how alternative methods could be a solution for the traditional problems in port development and why a port, city or country would feel the incentive to alter the traditional approach. This starts by gaining a better understanding of sustainable ideologies, such as Building with Nature, Working with Nature and Engineering with Nature. Furthermore, this part focuses on the subsequent step of investigating research on alternative (port) development. This includes adaptive port development frameworks such as Ecology Based Design Approach (EBDA) and Integrated Sustainable Port Design (ISPD), but also Adaptive Port Planning focused on flexibility and Brownfields, or Previously Developed Land (PDL) (Leger et al., 2016; Taneja, 2013; Vrolijk, 2015; Zheng, 2015).

In the third chapter a concept for a framework for transition ports is proposed. This will be developed by using previously developed concepts and additional information gained from the second chapter. The goal is to test the feasibility and desirability of this framework by applying it to the case of Havana, Cuba in consecutive chapters. The criteria for testing the framework will also be determined in this chapter.

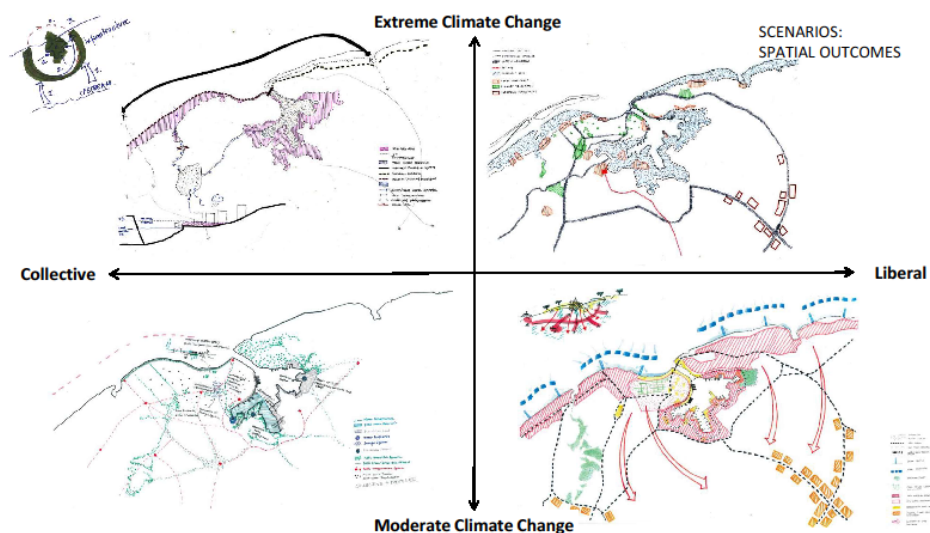
3.2 Part two: the case of Havana, Cuba

The second part of the thesis focuses on the case of Havana, Cuba. The entire case study is proposed to investigate differences between a conventional approach and the proposed adapted approach including the framework. Information about the transformation of the bay

in a conventional approach can be found in two sources: previous projects by TU Delft and the proposed master plan by Cuban governmental organizations ((PID-BH), 2014; Stam et al., 2013). These organizations will be referred to as the 'reference project' and the 'workgroup' of the government.

The developed framework is applied to transformation of the bay of Havana. In order to do so a thorough analysis of the situation will be executed. This will be done in collaboration with the students of the European Master of Urbanism (EMU) who collaborated to this thesis (Canazzi et al., 2016). In this research four leading challenges are found: flooding, pollution, segregation, congestion. The challenge is to find a way to combine these findings with the additional results of alternative port development. This requires analyses such as stakeholders, infrastructure, water (nautical, hydrodynamic), climate change and ecologic (water, flora & fauna, air) analyses. Especially the stakeholder analysis could be a useful tool to reveal the interests in the bay area by its users. Due to the special circumstances, the history and political climate also deserves extra attention. The aforementioned challenges have also been studied in reference (European) ports, and may provide insights to possible solutions.

Because the framework should be a versatile tool due to the complexity of Havana's future, it will be tested in the extreme scenarios of Cuba's future. These scenarios will be developed along so-called 'driving forces' that will be the main drivers behind the (possible) change in Cuba.



*Figure 2.2 -
Scenarios by use
of driving forces.
(Canazzi et. al.,
2016)*

4. Result

The outcome of the first part is a proposal for a framework of ports in transition. It will be applied to and tested on a case study of the bay of Havana, Cuba. This second part serves as an iteration to test the framework and simultaneously develops more insight in a sustainable design strategy for the transition of the bay of Havana.

5. Evaluation

To evaluate the proposed framework, it will be tested it will be tested to the criteria determined in previous chapters and compared to the traditional port development approach. To compare it to a conventional approach, the reference project will be used which consists of data and a design proposal for the bay of Havana as a tourist port (Stam et al., 2013). The versatility will be tested by performing the design steps, which are proposed by the framework. It will be reviewed under several future scenarios. The idea is that once the framework is able to function in these extreme scenarios, it will also be able to be applicable to the actual future of Cuba, whatever future that may be. This study will also lead to recommendations for further research and adaptations to the proposed framework.

6. Reader guide

As stated before it is stressed that the main purpose of this thesis is educational, although some information might be applicable for further research as well.

For those readers interested in the theoretical background of ports in transition, the first part is recommended. This consists of information about traditional port planning (chapter 3), incentives for a different port development (chapter 4) and the current alternative port development strategies, often based on Greenfield sites. Furthermore a alternative framework for the port transition of the port of Havana is proposed, which might also be applicable to other ports in transition (Chapter 6).

The second part describes the case study and executes the proposed framework step by step (chapter 8 - 14) and evaluates this for further research (chapter 15).



Part one - Research

3. Traditional port planning

1. Introduction

With the increasingly dynamic and globalized world, sea ports – who among other enable this globalization to take place – are facing difficult challenges: either they need to adapt to modern demands or accept a loss in the share of the global trading market. The latter is usually far from preferable, but with the high (risky) investments required for large scale port adaptations, it sometimes is the only option.

This chapter aims to capture the essence of the traditional port and its subsequent port planning procedure. It thereby answers the question: why is traditional port not able to meet the demands of today nor the future and thus, why is a change in port planning strategies inevitable?

The chapter consists of information about the traditional port (3.2), traditional port development (3.3), problems with traditional port planning (3.4) and the conclusions (3.5). Background information can be found in appendix A.

2. The traditional port

In 1986 “Branch (1986, p.1) defines a port as follows: “(A port is) [...] a terminal and an area within which ships are loaded and/or discharged of cargo [...] Usually, it has an interface with other forms of transport and in doing so provides connecting services.”” (Schipper et al., 2015). However, we notice that the port has become part of an increasingly complex world. “A port can be seen as a dynamic, open, and complex engineering system subject to highly uncertain external influences. Uncertainty is as any departure from the unachievable ideal of complete determinism.” (Taneja, 2013)

3. Traditional port development

Traditional port development is merely focused on functionality by means of economic value and governmentality (fig. 3.1).

According to ISPD the traditional port development framework is the following (Zheng, 2015). A traditional port master plan indicates in what way port operations could be organized. It does not include a

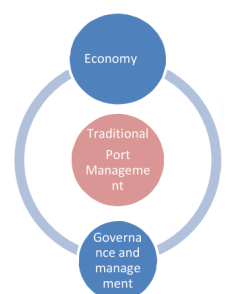


Figure 3.1 Traditional port development (Schipper et al., 2015)

construction plan, but should provide guidelines and policies to oversee the future development of a port and accommodate safe local and international waterborne freight. The most relevant products of a master plan are the port layout and the description of investment in infrastructure. The main objectives of a port master plan in general are as follows (Cork et al., 2014)

- Promote the 'vision' for the port by active stakeholder engagement.
- Develop the port in line with (inter)national legislation and guidelines.
- Combine and integrate economic, environmental, safety and technical aspect in the overall plan.
- Support long term development and growth of the port by creating functional port facilities and operational areas.
- Allow enough flexibility for the port to react to changing forecasts, technology, regulations and legislation and port competition.

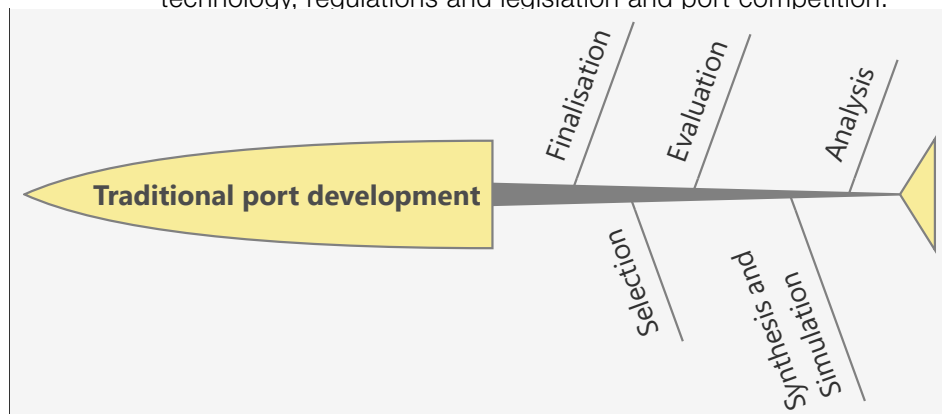


Figure 3.1 - Traditional port development (own work)

According to Ligteringen, the traditional approach can be divided into the following four main elementary design cycle steps (Ligteringen, 2012) (fig 3.1).

1. **Analysis** – Data concerning the location and (expected) situation of the port is collected. Forecast are made of the cargo flow and the fleet composition, the environment and safety aspects are studied and physical site data is required as well such as bathymetry, wave conditions, currents and horizontal tide, water levels and vertical tide etc.

2. **Synthesis and Simulation** – With the acquired knowledge of the analysis, several alternative concepts can be created and translated into two to three most favorable alternatives. These alternatives can be tested with the help of simulation models.
3. **Evaluation** – After the test results are known of the alternative designs, these alternatives can be compared to each other by the evaluation of specified aspects regarding the designs.
4. **Selection** – With the results of an evaluation method, one masterplan alternative is selected.
5. **Finalisation** – By selecting the most desired masterplan, the general objective is fixed as well as the direction of solution. The selected design however still needs to be optimized concerning nautical, hydraulic, financial and environmental aspects. This can be done with detailed site investigations.

4. Problems with traditional port planning

Traditional port planning brings about various problems for which solutions have to be sought. More background information on the flaws in of traditional port planning listed below can be found in Appendix A.

The traditional approach, comprising elements such as master planning, infrastructure design, and project appraisal, starts focusing on short-term uncertainties resulting in an inadequate analysis (and sometimes decision) for the choice of location. This is due to the mixed interest and long distances between decision making parties such as the economist preparing demand forecasts (on which the plans are based), the engineer doing the planning, the investment manager who sets up the business case, and the decision maker. The linear planning approach followed for most projects means that the decision-making cannot benefit from new information that reduces uncertainty. The tools used for risk management do not allow planners to think in terms of uncertainty and therefore review the designs based on deterministic forecasts. Subsequent investment appraisal involves a financial evaluation in a business case, and the selection among alternatives is based on expected values. Flexibility can enhance the value of a project, but cannot be valued with traditional

methods. Decision making for a project facing multiple uncertainties on a single monetary value is likely to be misguided. The result is inflexible port layouts and infrastructure designs that are not functional under changing requirements. That ports have not been able to keep up with the changing requirements also lead to neglecting social and environmental interests, creating a merely economic focused project that does not serve the ecosystem as a whole. Clearly, a new approach is required. (Schipper et al., 2015; Taneja, 2013; Zheng, 2015)

5. Conclusion

This chapter tried to answer the question: why does a traditional port not work ideally? As the aforementioned concludes there are several aspects which prevent a traditional port from being able to operate ideally in our increasingly dynamic society. Summarized, this comprises the following aspects:

- **Location**

One of the most important observations from traditional port planning is the lack of a proper analysis on the choice for a location. Usually, the port authority is in charge of the location selection whereas the design process is done by an engineering company. This split in responsibilities leads to a discrepancy in the decision making with unfavorable port locations as possible outcome.

- **Flexibility**

Traditional ports are not flexible to adapt to unforeseen events. This can cause costly adaptations or a loss in market share. The inability to have a flexible port as an outcome of the traditional design process is caused by the following aspects.

- **Slow design process**

The linear design approach is prone to a long time scale for the entire design process and makes it unable to enact upon uncertainties in the future or changes in the environment (e.g. economic, social, environmental, legislative, etc.) that have already taken place.

- **Mixed interest of decision making parties**

Besides the speed of the design process, different interests and responsibilities by these governments, companies and organizations can result in a poor choice regarding economical, social and environmental aspects.

- **Method of decision**

As a result of these aforementioned mixed responsibilities and interests, uncertainties for short- and long-term vision are inevitable. Subsequent conflicting performance criteria lead to paradoxical solutions.

- **Method of investments**

Traditional investment decision making is based on the certainty of the return on investment. Incorporating flexibility to adapt to uncertain future scenarios is not valued appropriately. After all it is difficult to support spending extra costs in order to incorporate uncertain incomes of uncertain future scenarios. In the long run however, this might be the more sensible option since one can almost be certain about upcoming uncertainties.

- **Risk management**

Traditional risk assessments emerge from the tendency to predict the future in a deterministic way. However, the current tools used by these risk managers are poor predictors of change. In other words, the tools are trying to quantify the future, while the future is too uncertain to do so.

- **Social and environmental impact**

Historic rapid economic growth prevented a similar profit for social and environmental aspects to be incorporated in traditional port planning.

4. Incentive for a different port development

16

1. Introduction

Besides the investigation for ('internal') flaws of traditional port planning in the preceding chapter, this chapter aims to cover other ('external') incentives that port planners could have to alter current port planning procedures. Hereby it intends to answer the question: which incentives to change port planning procedures do port authority and planners have, besides the known flaws of the traditional planning procedure?

The chapter is divided in the paragraphs United Nations Sustainable Development Goals (4.2), global competition (4.3) and the conclusions (4.4). More information on paragraph 4.2 can be found in appendix B.

2. United Nations Sustainable Development Goals

Previously known as the 'Millennium Goals', the United Nations have developed the Sustainable Development Goals (fig. 4.1), which is "a set of goals to end poverty, protect the planet and ensure prosperity for all". These goals have specific targets to be achieved until 2030 (United Nations, 2015). Due to the variety of functions that a port can serve, several of these goals are applicable to the field of port.



Figure 4.1 - United Nations Sustainable Development Goals (United Nations 2015)

Since Cuba is one of the member states of the United Nations, this report will assume that regardless of the upcoming developments or changes in Cuba, the support to contribute to these goals is sincere and will remain unaffected.

Relevant themes for port development are outlined below, more information can be found in Appendix B (United Nations, 2015).

1. Clean water and sanitation
2. Affordable and clean energy
3. Decent work and economic growth
4. Industry, innovation and infrastructure
5. Reduced inequalities
6. Sustainable cities and communities
7. Responsible consumption and production
8. Climate action
9. Life below water
10. Life on land
11. Partnerships for the goals

3. Global economy

Ports are becoming more than in the past part of a global economy and thereby face the decision between adapting to a more competitive, sustainable situation, or losing market share by the ongoing global competition. (UNCTAD/RMT/2015, 2015). The incentives for ports to change their current procedure also have a historical explanation. “During the 19th century and first half of the 20th century, ports tended to be instruments of state or colonial powers and port access and egress was regarded as a means to control markets. Competition between ports was minimal and port-related costs were relatively insignificant in comparison to the high cost of ocean transport and inland trans-port. As a result, there was little incentive to improve port efficiency.” (World Bank, 2007a, 2007b)

Nowadays ports are increasingly competitive in order to keep up with the global economy, which leads to more efficiency, lower cargo handling costs, and integrated port services with other components of the global distribution network (World Bank, 2007a, 2007b).

The ongoing competition and is shaped by the following five developments: the rivalry among existing competitors, the threat of new competitors, the potential for global substitutes, the bargaining power of port users and the bargaining power of port service providers (fig. 4.2).

5. Conclusion

The discovered 'external' incentives for port planning to change are the United Nations Sustainable Development goals and the ongoing global economy of which ports are part. The latter leaves ports to no choice but adapting to the ongoing changing requirements or accepting a loss in market share.

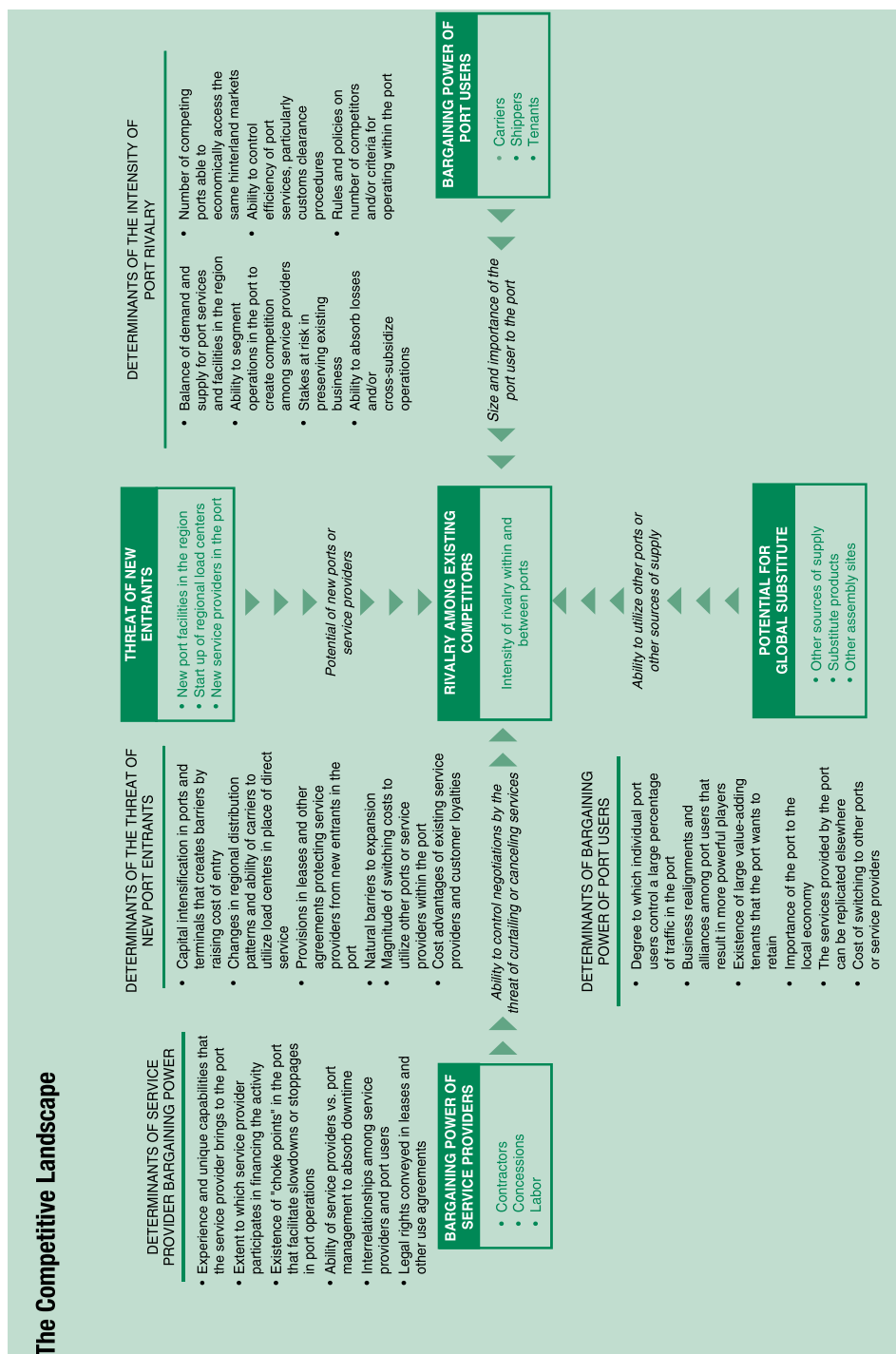


Figure 4.2 - Scheme of competition among ports (World Bank, 2007a, 2007b)

1. Introduction

As port planners and researchers start to acknowledge the urge to adapt traditional port planning, research and development of alternative port planning methods have been going on over the past years (Arecco, 2015; Schipper et al., 2015; Taneja, 2013; Vrolijk, 2015; Zheng, 2015). The majority of this research has been focusing on Greenfields by which we indicate new or expanding ports, whereas Brownfields has sometimes been left out of the scope (Leger et al., 2016). Nevertheless, Havana is not the only port facing a transition in main function and the subsequent infrastructure and facilities, nor will it be considering for instance the aging (city) ports in European countries. Clearly, the versatility of ports in transition is not (or never has been) ideal since sustainable ports try to embed the ability for port transitions in their design. Therefore this is of special interest for the purpose of port transitions. This chapter depicts the current alternative port planning methods and intends to answer the question: which alternative port planning methods currently exist, what do they have in common and how do they relate to ports in transition?

The chapter is divided in the following paragraphs. More information on the alternative port planning methods and Previously Developed Land can be found in Appendix C and D respectively.

2. Definition of the Sustainable port

In order for the framework to have a sustainable scope, a clear definition of 'sustainability' needs to be found in the abundance of reports and definitions available. This report combines the most appropriate definitions and is based on the definition as stated in the ISPD report (Zheng, 2015). The additional definitions can be found in Appendix C

"A sustainable port is a port which has achieved and is maintaining a balance in economic, environmental and social extent for the surrounding region whilst using a long-term vision to anticipate on future developments and the needs of future generations. A sustainable port uses the Earth's resources for its own benefit without affecting its capacities for future generations."

3. Sustainable design philosophies

Along with the rising awareness of environmental impact as a consequence of human interaction, different philosophies have emerged. All of them tried to alter the rather linear design ideology influenced by governance and economy to a more integrated alternative. In the EBDA report the following organizations are studied with regard to sustainable port development: ESPA and PIANC (PIANC, 2011, 2014; Vrolijk, 2015). The most significant ones are listed below. Additional information on the sustainable design philosophies can be found in Appendix C

- Building with nature – Ecoshape – 2008 ((Ecoshape), 2015)
- Working with nature – PIANC – 2008 (PIANC, 2011)
- Engineering with nature – USACE – 2010 (Bridges, 2015)

Based on these ideologies, the EBDA report concludes that with respect to sustainable port development, the following elements are adopted as the sustainable port definitions (Vrolijk, 2015).

- Multiple perspectives: (interlinked) economical, environmental and social.
- Planning under longer term uncertainties: the long-term vision
- The noted importance of active and early stakeholder participation, to be used as a tool to map the needs and requirements of an area as well as to co-operate with stakeholders to enhance the port development process by co-creation of values.
- Continuous learning process: incorporating progressive insights in the development process.

4. Alternative frameworks

Over the course of time, several frameworks have been developed to serve as a guide for port developments. These frameworks however have merely focused on either new or expanding ports. Studying these frameworks is a way to take existing knowledge into account when composing the framework for transition ports as intended in this thesis. For the ease of reading, only a summary of the studied frameworks will be presented and additional information is available in Appendix C.

Three alternative frameworks that have been used for this thesis are the following.

Integrated Sustainable Port Design Framework (ISPD)

The ISPD is based on the Building with Nature design philosophy, is recently developed (2015) and has a general set up which makes it interesting for the purpose of this thesis. However, one of the important conclusions is the importance of an adequate location analysis prior to the remaining steps. Due to the fixed location for ports in transition this is impossible to incorporate as such. Differences with traditional port planning include the following (fig. 5.1 & Appendix N).

- Analysis of physical, environmental, governmental and socio-economic disciplines of different potential suitable locations.
- Early stakeholder involvement during the location choice.
- Focus and a systematic outline of the values, opportunities of each potential suitable location.
- Turning values into key values after the preferred location is chosen. (Zheng, 2015)

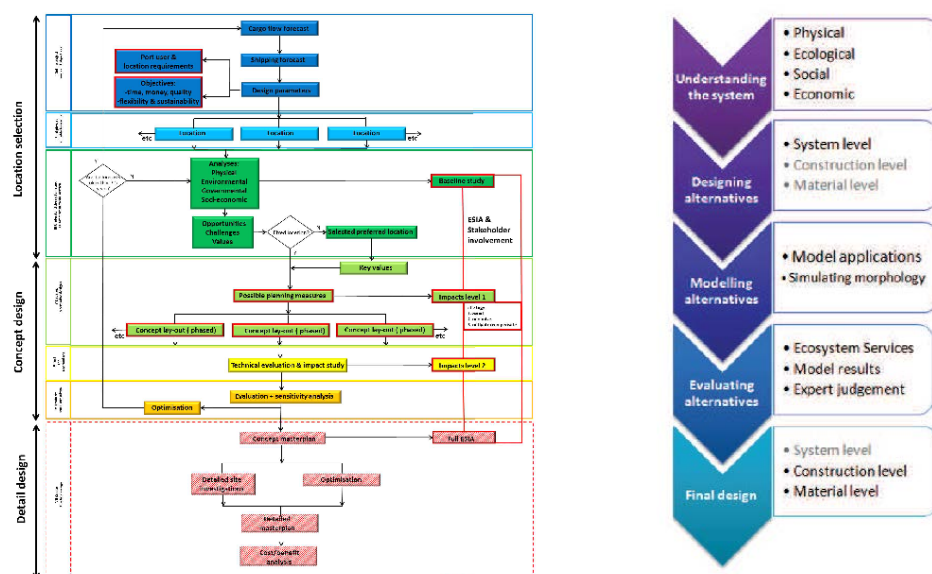


Figure 5.1 & 5.2 Scheme of the ISPD flowchart (left) and the EBDA (right)

Ecosystem Based Design Approach (EBDA)

The EBDA is also based on the Building with Nature philosophy but takes a slightly different approach as it underscores the need of focusing on the ecosystem as a whole as a leading thread for the further

design. With a top-down approach it is applied on three levels: system, construction and material. The research focuses on implementation of sustainability in the design-phase of a port development, targeting sustainable measures at the system level. (Vrolijk, 2015) (fig. 5.2)

Adaptive Port Planning (APP)

The APP aims to incorporate flexibility into port planning and distinguishes itself, as it does not function as a flowchart. It is based on three fundamentals:

- Embracing uncertainty
- Acknowledging the role of flexibility
- Actively pursuing innovation

As such it helps to better evaluate the desirability of a long-term investment, which leads to improved decision making (Taneja, 2013). Considering the unpredictable future for (the port of) Havana, this framework contains useful information for the development of a framework for ports in transition (fig. 5.3).

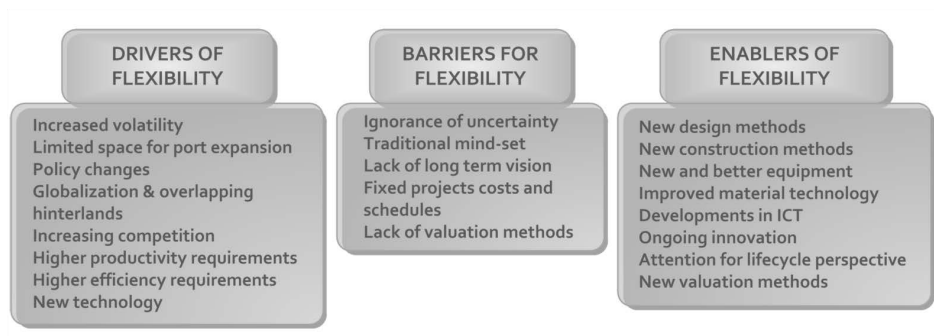


Figure 5.3 Adaptive Port Planning - barriers and enablers of flexibility (Taneja, 2013)

Port of the Future (PotF)

The ideal outcome of a PotF model is the so-called No-Impact Port, which should be achieved by cooperation between People Planet and Prosperity (PPP). It includes ecological, morphological, governmental and socio-economic disciplines. Each of these disciplines have a requirement for the location of the port, but contrary to the EBDA, this location is function driven. In other words it is based on the fear that some of the proposed functions of the port might not be able to operate in a

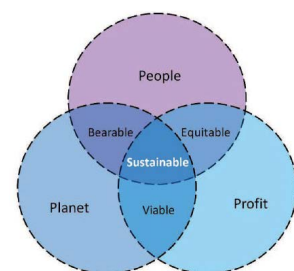


Figure 5.4 PPP: People, planet, profit. (Vrolijk, 2016)

sustainable manner at a certain location. The importance of People Planet Prosperity (PPP) is stressed in the model (Schipper et al., 2015) (fig. 5.4).

5. Previously Developed Land (PDL)

As a result of the rapid economic growth and globalization of the past decades, many port cities now face the challenge to deal with the sites that have been previously developed. In contrary to the majority of the sustainability methodologies, 'brownfield' sites or PDL focuses on the sites that were developed in the past, but do not meet the demands of our current standards anymore. Gaining knowledge about these sites has often been left outside of the scope of research. In order to alter this, PDL research tries to find solutions to these mistakes of the past. (Leger et al., 2016)

The definition of PDL refers to 'any land or premises which has previously been used or developed and is not currently fully in use ... It may also be vacant, derelict, or contaminated' (Alker et al., 2000, p. 49). [...] In planning terms, such land does not have to be derelict land and can be in partial active use, although it must be zoned for comprehensive redevelopment under a renewal scheme or masterplan. Although the term 'brownfield' is often used interchangeably with PDL, it strictly includes other forms of under-utilized land which has not been previously developed, such as quarries. (Sinnott et al., 2014, p. 9) (Leger et al., 2016). Sometimes the term 'greenfield' development is used to indicate a port expansion or the construction of a new port. (Leger et al., 2016)

More information about the enabling factors and barriers for PDL development can be found in Appendix D.

6. Conclusion

If the port wants to transit towards a sustainable solution, it will have to comply with the definition of a sustainable port. "A sustainable port is a port which has achieved and is maintaining a balance in economic, environmental and social extent for the surrounding region whilst using a long-term vision to anticipate on future developments and the needs of future generations. A sustainable port uses the Earth's resources for its own benefit without affecting its capacities for future generations."

The developments covered in this chapter form the core of the current approach of sustainable port development and serve as a guideline for the framework for transition ports. In order to use this knowledge later on in the thesis, we will now combine these developments to define the criteria that the transition port framework has to meet. These criteria have to be able to meet in various scenarios which are to be determined later in this thesis.

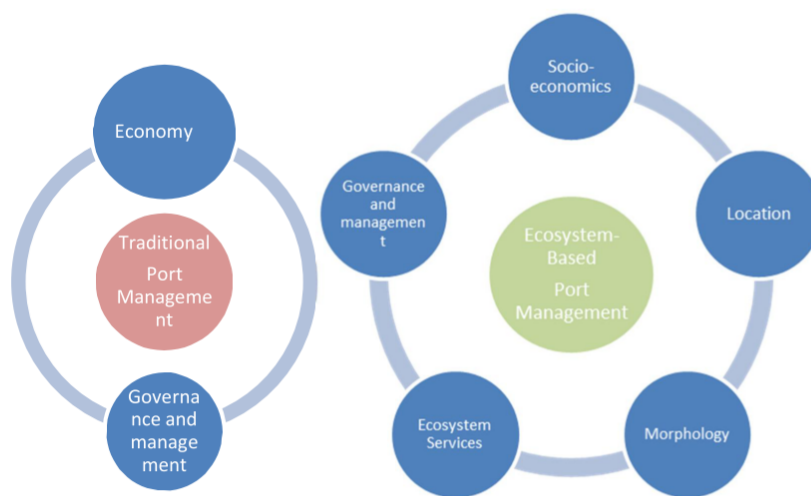


Figure 5.5 Multiple perspectives (Schipper et al., 2014)

Criteria

The criteria for the framework are the following

- **Multiple Perspectives**

In stead of the tendency to only embrace economic and governance related disciplines, the sustainable framework has to meet with an increased amount of disciplines to ensure a balance in economic, social and environmental interest (fig. 5.5). These disciplines that the design has to serve are the following.

- **Economics**

- **Investment embracing uncertainties**

The decision to invest should be based on more than merely the certainty of return of investment.

- **Risk management**

Current tools for risk assessment cannot include uncertainties

in their models. The deterministic approach does not allow for such preferences. Developing an alternative is recommended, but is beyond the scope of this thesis.

- **Governance and management**

The management of the traditional framework causes a lot of unnecessary inefficiency. Design process

- **Continuous learning design process**

The traditional linear design approach is prone to a long time scale for the entire design process and makes it unable to enact upon uncertainties in the future or changes in the environment (e.g. economic, social, environmental, legislative, etc.) that have already taken place.

- **Clear division between decision making parties**

The decision making parties should know very clearly which responsibilities they carry, both for short- and long-term goals.

- **Method of decision**

By ensuring the clear distinction of interest in the decision making process, the final verdict has to avoid paradoxical solutions. Preferably the decision criteria have to find a way to embed uncertainties in the method of decision. Developing this is beyond the scope of this research.

- **Brownfields**

Governmental stimulation on brownfields development might be necessary in case a negative legacy by previous port use is the case. Barriers to be tackled are: fear of unknown environmental conditions, fear of unknown contamination, regulatory controls, landownership constraints, potential delays prior to and during developments, increased development costs, negative image of brownfields that may lead to low or uncertain rental or sales revenues

- **Location**

In this chapter the importance of location has been emphasized and merely used to indicate the consequences of the first step of a port development, namely the choice of location. In the case of transition ports this doesn't correlate directly, since the location of the port itself is already set. However, locations of the specific functions within the port can still very important. Furthermore it

is worth mentioning that in the current frameworks, location is function driven, i.e. the proposed functions for the port have to fit as good as possible in one of the available locations. Since this does not work for transition ports as the location is already fixed, the proposal is to determine the location opportunity driven, i.e. within the available location, it has to be determined which functions are possible to include in the available space.

- **Environment**

The development of the port may not affect the environment (land, water, air) in any negative way. If however it does, the reason has to be elucidated and the negative influence limited as much as possible. Also a way of compensation could be considered. In order to include the environment in a effective way there should be an organization that is clearly responsible for the quality of the environment. Especially in the case of transition ports the negative 'brownfields' image should be tackled.

- **Society**

One of the aspects which was mentioned repeatedly was the so called early and active stakeholder involvement.

- **Morphology**

The outline of the port can have serious influence on the costs for operation and maintenance of the port with regard to dredging, sedimentation, coastal maintenance, maintenance on waterways, salt water infiltration, etc. Again, just like the location topic, this method can also be turned around. The available depth may indicate for which vessels the port will be suitable.

- **Flexibility**

In order to assure a sustainable approach, according to the design philosophies, a long-term solution as is required. Therefore the design has to embrace the (unknown) uncertainties of the future, i.e. the design has to be flexible.

- **Innovation**

In order to enable flexibility within the port, innovation in construction, design, materials, ICT and valuation methods are vital. These can push the drivers of flexibility to prevail over the current boundaries.

6. Framework for a port in transition

1. Introduction

Based on the research of sustainable port development which has been conducted for many years, this chapter will propose a framework to be used for the transition of the port of Havana and could possibly be beneficial for other ports in transition as well. After all, the focus of this research lied in studying new or expanding port, while little has been studied about ports in transition. Nevertheless, many ports worldwide face the need to drastically change the layout of their current port due to a changing environment in terms of global economy, and a rising awareness of interference with the social or environmental interests. This causes a discrepancy between the functions of the port and the actual needs of the surrounding region.

The chapter is divided in the following paragraphs: ideology of the framework (6.1), More information about the framework for a port in transition can be found in appendix E.

2. Ideology of the framework

The ideology of the framework resembles the EBDA, which is derived from the UNEP report, the Ecosystem-based Management Markers for Assessing Progress and the PhD-thesis by Susan Taljaard (An implementation model for integrated coastal management in South Africa – from legislation to practice) (Taljaard, 2011; UNEP/GPA, 2006; UNEP, 2014). More information on the ideology of the framework can be found in Appendix E.

Within the ecosystem-based management that is used for this ideology the following aspects have to be met.

- The goods and services of the ecosystem (i.e. natural environment, social and economic dimensions) are placed centrally in the management process (versus sectors being central to the management process).
- The concept of spatial scale is incorporated, with interdependent plants, animals and human communities that interact within distinct spatial units (ecosystems).

- Participatory stakeholder involvement (i.e. resource management with multiple stakeholder groups).
- Cooperative governance between different stakeholders is required in the management of the ecosystem. This management model has been adapted to be useful for port planners and serves as an important base of this framework". (Vrolijk, 2015)

3. Guidelines

The framework will be developed in a bottom up approach (Zheng, 2015). The framework consists of the following steps.

1. Understand the system
2. Prioritize remaining elements (Essential, Preferable, Unnecessary)
3. Evaluate project needs and objectives (and adapt them if necessary)
4. Develop alternative designs (optionally use future scenarios)
5. Test the design alternatives
6. Evaluate the qualities of each alternative
7. Create the final design

The entire framework should be interpreted with a long-term vision in mind. These steps that make the framework will be explained briefly.

- For whatever reason the port does not meet the needs and has to be transformed. At this point the system in which this port operates will have to be understood very well. What has to be clear is both why the previous port did not function, but also an analysis as complete as possible about the ecosystem that the port and/or the bay are operating in. This research has to be carried out with a long term (flexible, innovative), multi-disciplinary (social, economic, environmental, morphology, location, governance) vision. Analyses to be carried out are among others stakeholder, site, economic, landscape, ecologic and political.
- Second, after understanding the system, it can be determined which parts of the remaining port must leave, which could stay and

which are vital for further development of the port. This is where the framework clearly distinguishes itself from current frameworks.

- Third, after carrying out the analysis of the bay area, it is possible to determine feasible goals for the project. In this stage the needs and objectives have to be determined. This includes a distinction between must-haves (must-haves) and objectives (nice-to-haves). In order to obtain a feasible solution for the long term the short- and long-term goals have to be separated clearly.
- Fourth, alternative solutions for the port or the bay are proposed. These designs have to comply with the goals from the previous steps.
- Fifth, the alternatives have to be tested. The conventional evaluation methods used for this step, will have to be improved for future development. As stated, this is beyond the scope of this research.
- Sixth, the outcome of this test has to be interpreted and evaluated. These outcomes serve as the base for the last step.
- Seventh, the evaluation of the alternatives provided the input to develop the final design.

4. Scenarios

This paragraph will elaborate on the use of scenarios as part of the design and evaluation of the case study. Although the actual content of the scenarios will be dealt with in the second part of the report, the theoretical outline will be discussed already.

The idea of using scenarios as part of the design process originated in previous research conducted by (Canazzi et al., 2016). The supporting notion is that at least for the situation in Cuba, but possibly also for other ports in transition, the future is highly uncertain. The situation leaves many guessing which developments are to be expected from the Cubans regarding several aspects such as politics, economy, trade, public services, etc. (Balingit, 2016). Since the 'system' has to be analyzed in the first step of the framework, this thesis assumes it will also be possible to investigate such developments. In case of uncertainties, one could consider the use of scenarios.

The uncertainties will be called 'driving forces' since they represent the driving forces for change. By discerning one or several of these driving forces, one can compile 2, 4, 8, etc. scenario's. It is for this

reason that we recommend to limit the driving forces to a maximum of 2 or 3 depending on the time and other resources available for the research or analysis. Furthermore it should be recalled that using these scenarios should only be used as a tool for improved understanding of the situation, but using this tool is not a goal per se.

5. Conclusion

The framework that will be used is largely based on the Building with Nature (Ecoshape, 2015) design philosophy, which is also used for many adapted port planning frameworks for Greenfield port development. The framework for the port in transition - Havana, Cuba - will consist of the following steps:

- Step 1: Understand the system
- Step 2: Prioritize remaining elements (Essential, Preferable, Unnecessary)
- Step 3: Evaluate project needs and objectives (and adapt them if necessary)
- Step 4: Develop alternative designs (optionally use future scenarios)
- Step 5: Test the design alternatives
- Step 6: Evaluate the qualities of each alternative
- Step 7: Create the final design

To be able to cope with the unpredictable future of Havana, this report will make use of scenarios that are composed by means of investigating the driving forces for change. In total, 4 scenarios will be used.



Part two - Case study

7. Introduction

1. The case study

By means of application of the proposed framework that followed from the research (part I) to the case study of Havana, Cuba, the framework will be tested on feasibility and desirability and thereby directly contributes to answering the research question. The goal of the case study is to investigate whether using the framework for transition ports would lead to different insights and outcomes if the framework for transition ports is used. It will be done under various scenarios to be determined in the analytical part of the case study. Chapter 8 starts by a thorough analysis of the bay area of Havana, Cuba. In succession the remaining elements in the bay of Havana are prioritized to determine which elements must stay. It is not until then that the project goals are determined, an affair that is usually resolved in earlier stages. Afterwards the design alternatives will be developed and tested under the previously proposed scenarios. Since the resources for this thesis are limited, assumptions are made if necessary.

The reasons why this case study is executed is not only because of the changing situation with respect to politics, climate change, economics or trade, but also because the government proclaimed that it has the intention to transform the bay into a tourist destination whilst sanitising the water in the bay up to safe swimming water quality ((GTE-BH), 2015; (PID-BH), 2014). These intentions are the ones that both the reference project and the alternative design will be based on. The governmental workgroup appointed by the government is in charge of this transformation and developed a masterplan. The reference project is also based on these governmental plans and designed a complementary marina (fig. 7.1-3) and ferry terminal for international ferries (fig. 7.4-5). Therefore both the reference project and the masterplan by the governmental workgroup will be introduced shortly. The combination of these reports will be referred to as ‘the reference project’.

2. The Marina and Terminal project

In order to include comparative feedback, the entire case study is based on previously conducted research (Stam et al., 2013). This report has been developed in 2013 and served as an inquiry into the possibility of

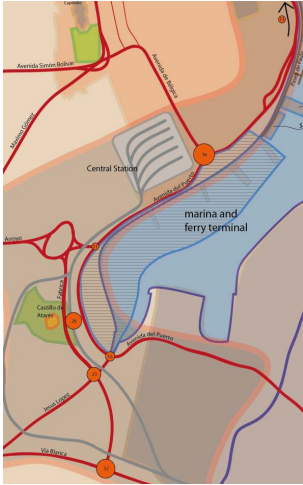


Figure 7.1 Overview of the location of the Marina and the Ferry terminal. (Stam et al., 2013)

transforming the port of Havana for touristic purposes. It will both be used for the analysis of the 'system' and the final outcome.

Although information is used from these reports, additional analysis has been done for this case study as well. Some differences with the conventional method used in the reference project are the steps to be taken (i.e. the framework) and a more integral analysis of the entire system before the must-haves and should-haves are determined and the design starts. Therefore special attention should be given to some of the additional analyses of the system (step 1), consisting of the stakeholder analysis, reference projects and environmental impact analysis.

Ultimately, these results will give insight in the strengths and weaknesses of this framework. This chapter will also serve as a starting point for the evaluations and recommendations for further research and development on this topic.

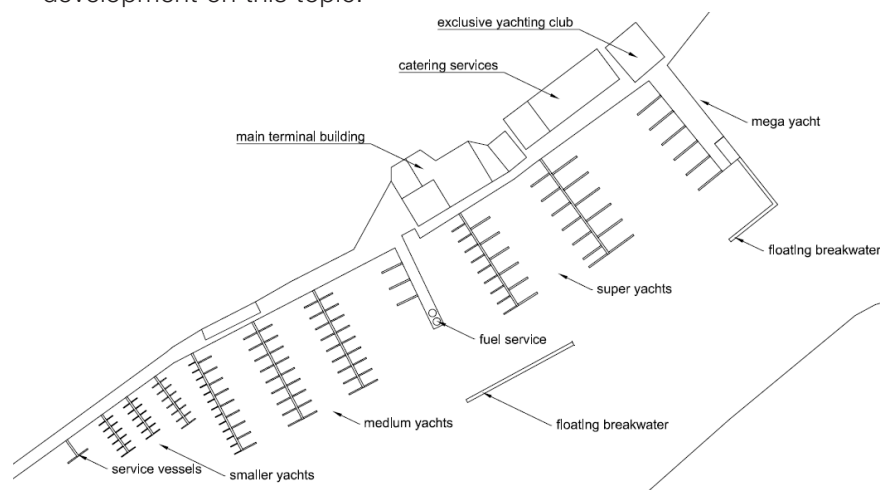


Figure 7.2 Overview and layout of the Marina (Stam et al., 2013)



Figure 7.3 Artist impression of the Marina (Stam et al., 2013)

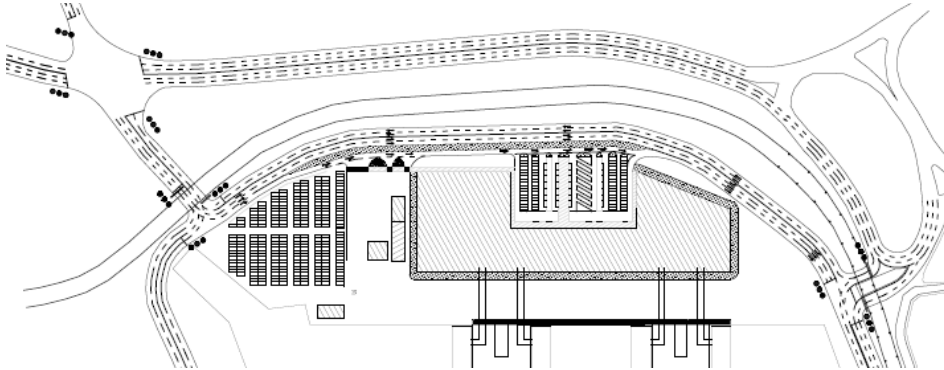


Figure 7.4 International ferry terminal and the connecting infrastructure (Stam et al. 2013)

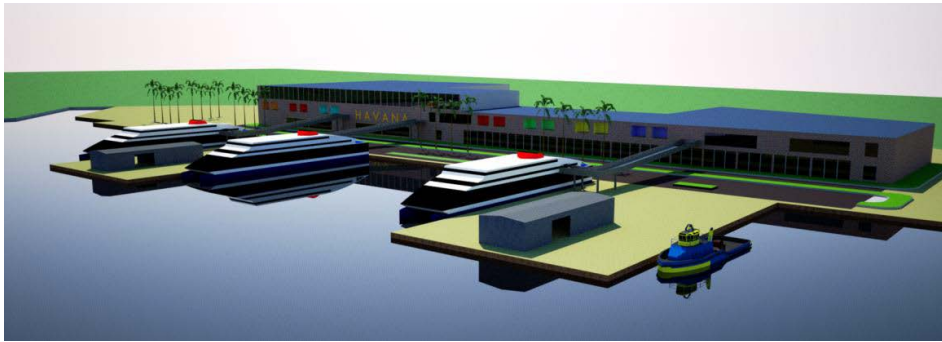


Figure 7.5 Artist impression of the International ferry terminal (Stam et al., 2013)

3. The governmental workgroup

The governmental workgroup (PID-BH) is appointed directly by the government to organize the transition of the bay of Havana. They also developed a masterplan for the redevelopment of the bay. An impression of the masterplan is given below. Although it is uncertain what kind of approach or framework the committee used, the masterplan comes across as traditional, with a clear focus on functionality and economy. This masterplan will be part of the ‘reference project’.

The goal of the masterplan is clearly to target the international tourism market by focusing on constructing cruise terminals, hotels, marinas and large commercial zones in nearly all areas of the bay.



Figure 7.9 Large hotels , an aquarium and ferry terminals at Peninsula Cavo de Cruz ((PID-BH), 2014)

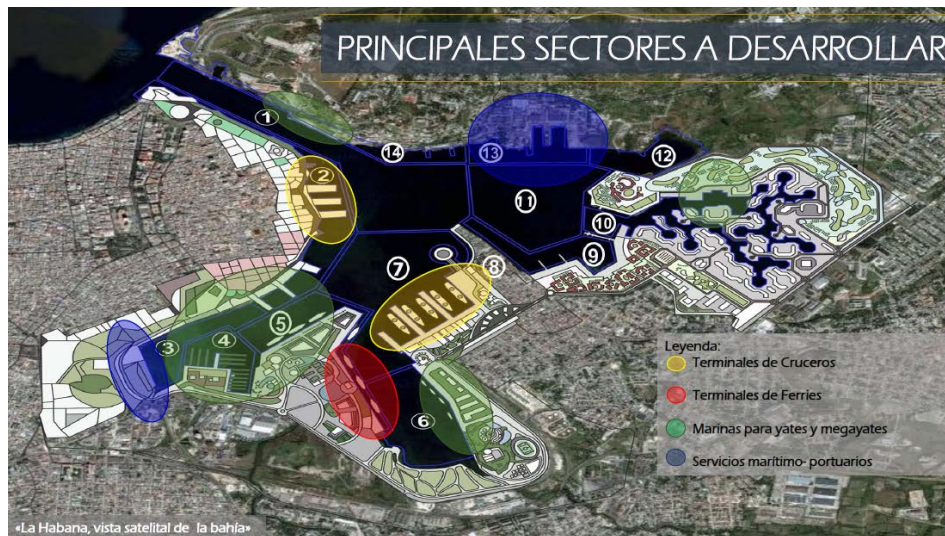


Figure 7.10 Spatial zoning of the masterplan, focusing on cruise and ferry terminals, marinas and remaining services.



Figure 7.11 Possible developments in Havana, including cruise and ferry terminals, marinas, nautic activity, naval services, tourist apartments, recreation, theme parks, aquatic parks, aquariums, convention centers, fair grounds, office

Figure 7.12 Large cruise vessels at Peninsula de Regla. (PID-BH, 2014)



8. Step 1: Understand the System

1. Introduction

The 'system' in this context signifies the location (the bay of Havana, Cuba) and all stakeholders (e.g. governments, businessmen, citizens, etc.) or processes (e.g. port activities, natural processes) that either influence the location or are being influenced by this location. To understand this complex system in this part of the framework, as many aspects as possible are studied in the greater region of the bay of Havana in order to obtain a comprehensive overview of the system. This means that several analyses will be carried out. The complete version of these analyses can be found in Appendix F,G. For a deeper understanding of the reference project and the analyses of hydrodynamics, infrastructure, nautical situation, finances, economics and project planning which this design is based upon, the reference project should be reviewed (Stam et al., 2013).

2. Scenarios

The case study of this thesis will be used to test how feasible the framework is in reality. However, due to a limited amount of available data and a highly unpredictable future for Cuba, this case study will be applied to hypothetical future scenarios. These scenarios are composed by two so called 'driving forces' which will strongly influence the future of the bay of Havana, Cuba: climate change and political environment. For practical reasons these driving forces are limited to two, creating a total of four different scenarios, which also corresponds to the method applied by the EMU project (REFERENCE FIGURE) ((Canazzi et al., 2016)). Besides elaborating on the scenarios, this paragraph will also shortly discuss other driving forces. Later on, the four scenarios will be covered. More information on these driving forces can be found in Appendix F.

3. Driving forces

Cuba finds itself at a tipping point. While the international travel and trade ambitions seem to alter, the future remains uncertain. As of now, the government shares little information about its plans. Therefore the use of driving forces is introduced: important developments with strong

opposite outcomes which are relevant for the bay of Havana and which influence its future. Research conducted by EMU led to the following driving forces (Canazzi et al., 2016):

- shifting port activities (competing port of Mariel)
- **climate change**
- **politics (socialism vs. capitalism)**
- social customs (collective vs. individual lifestyle)

Out of these driving forces, two are selected for further development: climate change and politics. These driving forces make up four future scenarios. It is important to note that these scenarios are 'extreme' and hypothetical scenarios in order to test the boundaries of the framework.

Table 8.1 - The future scenarios for Havana, Cuba.

| Scenario 1 | Scenario 2 |
|----------------------------------|----------------------------------|
| – Large effect of climate change | – Large effect of climate change |
| – Socialistic approach | – Capitalistic approach |
| Scenario 3 | Scenario 4 |
| – Small effect of climate change | – Small effect of climate change |
| – Socialistic approach | – Capitalistic approach |

3.1 Climate change

Climate change is one of the driving forces for change in the bay of Havana. Not only because it would indicate more expenses as a consequence of the damage to the city itself, but also because the Caribbean is very climate change dependent. Therefore tourism would drop significantly if this were to happen (Honey, 2016). For a port considering tourism as its main function this is therefore very worthwhile to investigate the possible consequences. Therefore it is important to include the most accurate and recent information available. For this reason this study uses the projections of the IPCC assessment reports as our indicators. In the reference design the 4th IPCC assessment report from 2007 has been used. For this study we will use the 5th report from 2014 (IPCC, 2014). The outcome can be found in table 8.2.

Table 8.2 - The effects of climate change on the future of the bay area.

| | Large effect | Small effect |
|---|--|--------------------------------------|
| Air temperature (rise by 2100) [°C] | 4.5 | 1.5 |
| Sea level (rise by 2100) [m] | 0.85 | 0.26 |
| Extreme weather events (storm surgers, tornados, etc.) | - Higher intensity (12%) -Possibly higher frequency | - Same intensity - Same frequency |
| Social impact | Disrupted livelihoods Health issues: more diseases, casualties and victims | None |
| Economic impact | Costs of critical services will increase (e.g. networks and infrastructure) | None |
| Environmental impact | Increased pollution of (natural) water, flora and fauna loss of certain biodiversity and ecosystem goods | None |

3.2 Politics

In order to comprehend the political complexity it is worthwhile to understand more of Cuba's political heritage, especially since Cuba was highly influenced by the political changes in the 20th century. The entire analysis is available in the appendix. Once again, we will only present the outcomes of the different scenarios. Table 8.3 indicates the differences of the scenarios.

Table 8.3 Political scenarios and the subsequent consequences.

| | Socialism | Capitalism |
|---|---|--|
| Type of government | Large and centralized | Small and decentralized |
| Entrepreneurship | Allowed for small and middle-sized companies in certain (regulated) industries | Allowed for all industries and all size of companies |
| Decision making process for the port of Havana | All government (related) organizations control the process | Private and public sector allowed in the process |
| Foreign investment | Regulated or restricted | Fully allowed |

4. Stakeholder analysis

The goal of the stakeholder analysis is to investigate the interests of all concerned parties and their subsequent supporting or disapproving attitude towards the proposed project. Although this is common practice for conventional design approaches, stakeholder analyses can be executed in several ways. In conventional design approaches such as the reference project, the stakeholder analysis is used to investigate the feasibility of implementing the proposed design. Must-haves and should-haves are determined beforehand. According to our study, this framework should be used in a more analytical way, i.e. to investigate the interests, needs and fears of all concerned parties in the system. Subsequent steps from (among others) this stakeholder analysis are determining the must-haves and should-haves for the project. Goal is to create must-haves and should-haves that contribute to a more sustainable and widely supported project. Similar to the conventional method we will use so called 'prioritizing' to indicate which stakeholders play an important role in the eventual decision making part.

Furthermore the stakeholder analysis has been executed for the four projected scenarios as well. This reveals the expected change in attitude and interest of the concerned parties. Since this study assumes a change in society in the (near) future, these additional analyses serve as an attempt to contribute to the long term strategy (i.e. support by society the project by means of thinking ahead of future changes in society and its subsequent relation towards the project.

Figure 8.1 (fig. 8.1) depicts the reference project. This indicates the current situation, more or less as presented in the reference project as performed by (Stam et al., 2013). The additional 4 analyses conducted can be found in appendix G. The results of these five scenarios will be explained shortly. Furthermore the general outcomes will be discussed.

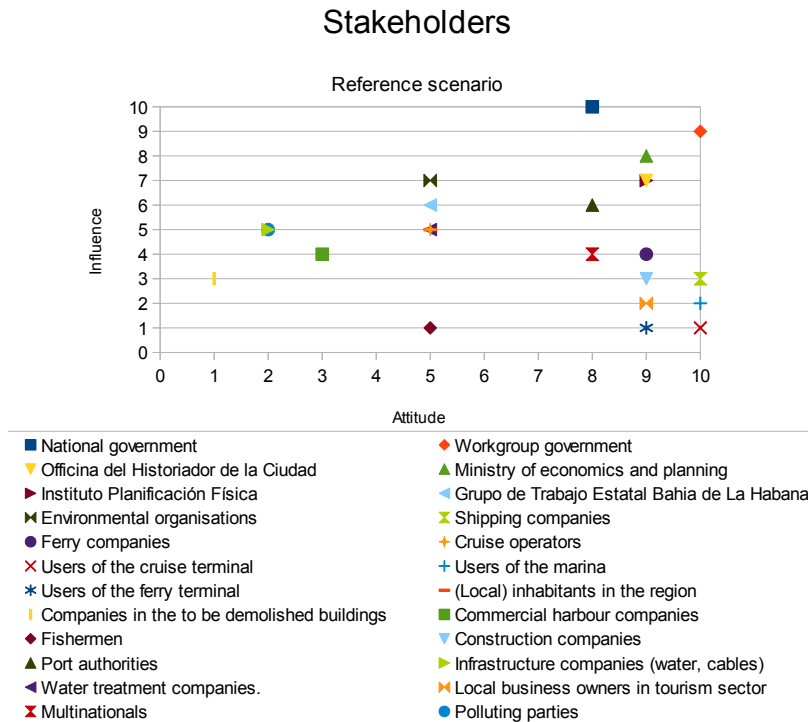


Figure 8.1 Visualising the influence and attitude of stakeholders.

4.1 High priority stakeholders

High priority stakeholders have a large influence in the project and are have a certain amount of power to influence the (outcome of the) project. Therefore the interests of these parties need to be reviewed carefully. Information on why these stakeholders have such a high priority can be found in appendix G.

- National government
- Workgroup
- Environmental organizations
- GTE-BH
- (local) inhabitants in the region
- Multinationals
- Industry in port area
- Polluting parties

From these stakeholders the environmental parties (and citizens) tend to have an opposing view towards the reference project. Since this analysis is part of an early stage investigation how the stakeholders would see the project, there would be enough time to understand the concerns

of these opposing parties. These parties do not have to be ‘convinced’ of the importance of the project, in stead, the decision making parties should try their best to understand these concerns and implement these in the design.

4.2 Other opposing parties

Besides the aforementioned opposing parties (citizens and environmental organizations) other opposing parties with smaller influence are the following.

- Polluting parties
- Water treatment companies
- Infrastructure companies
- Companies in the demolished buildings

The common thread among the polluting parties is that these all face the results of in the transforming bay of Havana. This could lead to a loss or interference of work. Depending on the (environmental) restrictions, these parties would have to alter their business strongly. With the conventional design however, these restrictions are assumed to be relatively mild. Although a long-term vision should incorporate a solution for these aspects, this might be beyond the scope of the project. However, it is recommended that in reality an integral plan would provide a solution for these opposing parties.

4.3 Influence driving forces: climate change and politics

From the designs it can be concluded that effects climate change has a negative effect on the ability to implement a sustainable long-term vision project since more people could feel the urge to quick and effective solutions. Furthermore, the Caribbean is especially vulnerable to climate change. If not properly addressed, climate change impacts will devastate the Caribbean’s tourism economy and travelers will abandon it for other destinations (Honey, 2016). Time to ‘understand the system’ and develop a thought-out project would be more difficult to justify and (non-governmental) environmental organizations will have less time and means to inform the society about possible results.

A centralized government can have a positive influence on the

outcome of the project, as long as the government truly prioritizes the must-haves and should-haves. On the other hand, citizen involvement could be smaller, since their opinion seems to matter less than in a more privatized system.

5. Tourism analysis

For Cuba, tourism is an important economic contributor as it is responsible for more than 10 % of the GDP (Gonzalez, 2016). Therefore, it can be understood why healthy tourist conditions for this industry are preferable. Havana is planning to become a tourist port and without embargo, Havana can finally benefit from the increasing (global) tourism market. Despite the remains of the former industrial port, the lack of existing tourist facilities might also be beneficial since it leaves many options for development open. This chapter studies the effects of (cruise) tourism on the island and specifically the city and bay of Havana. Besides the general numbers and current developments in Cuban tourism, this paragraph will also address the possibilities to host sustainable tourism in Cuba. The extensive analysis about tourism can be found in Appendix G.

5.1 Numbers

Cuba is an increasingly popular tourist destination. In 2015 a record number of more than three million tourists visited the largest Caribbean island and for 2016 3.7 millions are expected (fig. 8.2) (Gonzalez, 2016). With the downfall of the U.S. embargo more tourists are expected, especially from the United States. (Gross, 2016)

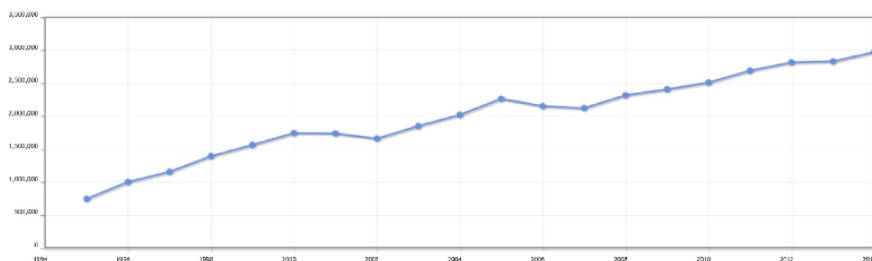
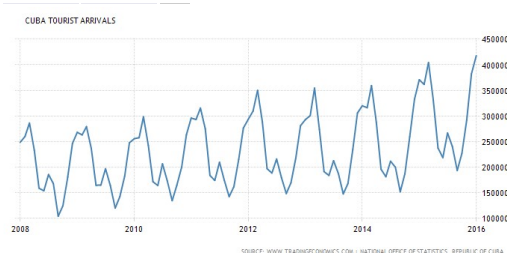


Figure 8.2 & 8.3
Rising amount of tourist
arrivals in Cuba
(1995-2014) (Indexmundi, 2014)
and (2008-2016)
(Tradingeconomics, 2016)



Economically tourism is a very important contributor. “Tourism is a major economic driver and employment producer in Cuba where it accounted for 10.4 percent of gdp and 9.6 percent of employment in 2014 with expected significant growth through 2024 including a 4.6 percent increase in total contribution to gdp (World Travel and Tourism Council 2015)” (Laitamaki et al., 2016).

5.2. Assets of Cuba for tourism

Before this chapter entails on further research on cruise tourism, it is worthwhile to discuss the assets that Cuba has to deploy sustainable tourism in general. These are (Honey, 2016):

- A healthy, well educated work force.
- Significant cultural and natural attractions: 10 World Heritage Sites, 275 National Monuments, 14 National Parks.
- Strong government role in tourism planning, policies, investment & operations.
- Dynamic small-scale private sector: paladares (local restaurants) and casas particulares (local bed & breakfasts).
- Havana: the most culturally/historically rich city in the Caribbean.
- Opportunities to create and capture the high value tourism market that is distinct from the Caribbean’s typical mass market, sun & sand tourism.

5.3. Environmental governance

The environmental governance is discussed on two levels: national and local.

- National – Caribbean Sustainable Tourism Policy (CSTP)
- Local – Port management analysis

6. Cruise tourism

Although several types of tourism could be hosted in the bay of Havana, for the purpose of this study, we will focus on cruise tourism, since this is a type of tourism discussed in the reference project and of general concern for further development. The focus of this sub chapter will be the investigation of common and other possible downsides to

cruise tourism, but also the advantages and best-case examples.

Although the cruise industry is a relatively small contributor in the number of tourists in Havana or Cuba, the impact for Havana and the environment is significant (Klein, 2011a). From an environmental point of view there are some considerations regarding environmental impact by (cruise) tourism. “A fundamental difficulty with sustainability assessments is that of quantifying and costing environmental impacts in the same way that economic benefits can be presented.” (Johnson, 2002) Although this quantification can be difficult, the LCA methodology helps by categorizing environmental impact of the cruise tourism industry. These impacts can be found in the following ways (Johnson, 2002). More information can be found in the appendix. The waste impacts are described extensively in this chapter.

- Infrastructure impacts
- Operational impacts
- Distribution impacts
- Use impacts
- Waste impacts

6.1. Actors

- Operators
 - Varying itineraries to avoid exceeding carrying capacity
 - Passenger numbers
 - Destination rehabilitation/conservation projects
 - Environmental management
 - Technological improvements to reduce operational impacts
 - Rewards for environmental awareness
 - Educational initiatives
- Destinations
 - How can destinations manage the impacts of cruise tourism
 - Which destinations are environmentally unsuitable
 - Economic measures
 - Can educational management tools help destination use impacts?
- Tourists
 - Have largely failed to exert the fundamental pressure necessary to ensure real environmental improvements.

The aforementioned actors can influence these impacts. These aspects will serve as the main advice to incorporate sustainable ways of hosting cruise tourism. Since tourists have failed to exert pressure to alter the way the cruise industry functions, it seems to be more effective to focus the tourism policy on the operators and destinations. By creating clear conditions for the operators and hosting cities, the situation could change. Among others because adding Cuba as a destination of cruise operators could be an advantage compared to other operators. If this is only possible for operators who ensure to limit their environmental impact, it could be a start to alter the common practices.

6.2. *Infrastructure impacts*

The further information about the infrastructural impacts can be found in the accompanied appendix.

6.3. *Operational impacts*

The reference study comprises an investigation on the nautical analysis in the bay. The assumption made is that the bay will transform into a tourist bay and will be used by cruise vessels and (a new) ferry. An overview is given of the design vessels, the existing nautical infrastructure, future growth and finally vessel interactions.

- Design vessels
 - Entrance channel

The depth of the channel, restricted by the tunnel beneath, limits the maximum draught of particularly cargo vessels like bulk carriers. The design vessel regarding the entrance channel is therefore a cruise ship, which combines a relatively small draught with a wider beam.

The maximum dimensions of a cruise ship are limited by the length of the pier of the cruise terminal. The maximum length of a ship the terminal can accommodate is 245 m, so an example of a normative vessel is the “MS Zaandam” with dimensions of 237x32.3x8.1m³ (Stam et al., 2013). This signifies a large vessel (i.e. 2.000 tourists) and one smaller one (i.e. 700 – 800 tourists)

- Mega yachts

Mega yachts will be normative for the dimensions of the marina. Examples of mega yachts are the 'Amels 180' with dimensions of 55x9.4x3.4 m³ or the 'Limitless' with dimensions of 97x12x3.7 m³. The national market for yachts in Cuba is currently non-existing as the only inhabitants with a private boat are fishermen (Valle Benero, 2013). It is therefore expected that the marina in the Bay of Havana will hardly be used as a homeport. (Stam et al., 2013)

- Intensity and future growth

Little is known about the current shipping intensities in the Bay of Havana. Only the container terminal has regular calls with three times a week. By account of the traffic control service, on average one liquid and one dry bulk vessel arrive per week. In general, two or three vessels arrive at the port on an average day. According to local experts this will change rapidly with the development of the port of Mariel and the transformation of the bay of Havana.

The expected economic growth in Cuba, especially after the possible lifting of the embargo, will lead to an increase in commercial activities in the country and the Bay of Havana. Moreover, as a result of Tourist Port Havana, an increase in traffic of tourist related vessels is to be expected. The overall harbour activities will as a result intensify, and thus more calls and traffic are expected.

In order to become successful, it is vital that the port can accommodate future tourist supply in a safe and comfortable way. Conflicts must therefore be prevented by providing sufficient capacity and/or a traffic control system. Hindrance of tourism and commercially related vessels must be minimized as much as possible.

The intensity of traffic in the bay that can be expected partly depends on the development of other ports on the island. Cargo ships can be attracted by other ports in Cuba by for example better equipment, shorter sailing distances, shorter service times or to avoid waiting times. As a result, the number of calls in the Port of Havana could be negatively affected. Cuba has a total of seven major ports: Havana, Mariel, Santiago de Cuba, Cienfuegos, Matanzas, Antilla and Nuevitas (Achermann, 2007). Especially

the developments in Mariel will influence the future of the Port of Havana.

Marinas in other parts of the country can conversely cause an increase of the number of calls of yachts in Havana. With multiple marinas in the country, Cuba would be a more attractive destination for yachts as it would make a trip around the island possible. Marinas in the close proximity of Havana will of course have a negative effect on the number of calls in the future marina. (Stam et al., 2013)

6.4. Distribution impacts

The further information about the infrastructural impacts can be found in the accompanied appendix.

6.5. Use impacts

The use of the bay of Havana will partially be determined by the use of the nautical traffic. This has been investigated in the reference study as well. The most important outcomes will be shortly discussed.

- **Nautical traffic**

The nautical traffic is limited in terms of manoeuvrability. The entrance channel is not accessible for windspeeds of 6 Bft and higher. This happens 5% of the year. Furthermore the width can be an important factor to take into account if vessels would increase in size.

More importantly, the traffic has to be regulated and prioritized. Vessels calling the Port of Havana are divided in four categories: cruises, ferries, yachts and cargo ships. The recommended order of priority is given below and the accompanied argumentation can be found in the appendix. (Stam et al., 2013).

1. Ferries
2. Cruise ships
3. Cargo vessels
4. Yachts

6.6. Waste impacts

“Cruise ships represent less than 1% of the global merchant fleet yet it has been estimated that they are responsible for 25% of all waste generated by merchant vessels. This volume of waste produces pressures on the environment, particularly with respect to ship-generated waste disposal at home ports and ports of call.” (Butt, 2007) For Havana’s future situation as port of call (likely) or home port (less likely) this is an interesting development. This chapter will try to capture the essence and impact of waste generated by cruise ships in order to learn from the mistakes from the past and to have a stance on the discussion whether to approve or disapprove development of cruise industry in the bay of Havana.



Figure 8.3 Wastewater emission of MSC Lirica on 13.10.2006. in front of Old port of Dubrovnik. UNESCO heritage site. Source: dr.Adam Benovic (Caric and Mackelworth, 2014)

Context

The oceans and seas of the world have suffered environmental degradation for many years and the need to prevent further degradation was highlighted at the Rio Earth Summit. A major cause of this degradation is pollution, with the world’s oceans being a receiving area for both land and ship generated pollutants, including waste (fig. 8.3). Waste can be defined as anything superfluous that no longer has a purpose; be it out of date white goods, food waste, packaging waste, sewage, toxic by-products from manufacturing and so forth. Waste is a global issue that looks set to grow as we enter the 21st century. The problems associated

with this waste generation and its management is now high on the political and environmental agendas of many countries and organizations, including the United Nations and hopefully Cuba. (Butt, 2007)

“At the end of 2004 there were 441 operational cruise ships, equivalent to 11.5 million gross tonnes, with the average age of the vessels being 21 years. As the cruise market continues to grow, so too will the amount of waste requiring disposal. How this waste is dealt with and the impacts of this waste on the environment will vary according to the waste management plans and facilities at home ports, ports of call and the waste management systems on board individual vessels. Irrespective of these plans, there will be environmental impacts, which have the potential to be substantial, particularly for small islands, home ports and ports of call.” (Butt, 2007)

The literature describes cruise ship-related pollution as highly intensive (Clark, 2001) and potentially hazardous to the existing tourism in visiting destinations (Klein, 2008). Flexibility and mobility of cruise ships, in combination with the intensity of their impact, create a new and unique phenomenon in (Caric, 2011) tourism, and also a problem in environmental protection (Caric, 2010). Cruiser vessels exert their negative effect on the marine environment through various different pathways and in many in-stances management fails to adequately prevent or absorb the environmental damage (Caric, 2010, 2011, 2012). Concerns are being raised regarding the fact that degradation of environmental quality, scenic landscapes, and destinations’ attractions, do not directly affect the cruise companies, as they can simply transfer their activities elsewhere. Furthermore, many stakeholders raised concerns over environmental misconducts cruise companies were either investigated or prosecuted for (Copeland, 2008; GAC, 2000; Klein, 2008). (Caric et al., 2016; Caric and Mackelworth, 2014)

Cruise tourism and sustainability

It is stated before that the government of Cuba wants to improve the environmental quality of the bay area of Havana. At the same time it is considering to serve as a cruise tourism destination. Questions can be raised whether these two goals can be combined, in other words, if cruise tourism is or can be organized as a sustainable form of tourism.

The cruise industry is a rapidly growing sector of tourism. Estimated growth rates for the industry are in the region of 8.5% p.a., with

passenger figures expected to reach 14.2 million by 2010 (Butt, 2007). By its very nature cruising cannot be classed as a sustainable form of tourism because these vessels are incapable of functioning without outside intervention and use significant amounts of resources; consequently they exert great pressure on and generate impacts on the places they visit. Passengers partaking of cruises are invariably attracted to those parts of the world that can be described as 'ecologically vulnerable' or as 'bio-diversity hot spots', which cannot or struggle to assimilate the added pressure that these vessels place on their fragile environments. Another study confirms this paradoxical dependency of cruise tourism "Paradoxically, environmental degradation ultimately decreases the quality of resources tourism is dependent upon." (Caric and Mackelworth, 2014)

The Caribbean islands are responsible for the largest share of global cruise tourism. Therefore Cuba and Havana have to decide whether they want to join the tendency of stimulating this kind of tourism at the conventional matter for economic reasons. This seems to be the case if we look at the reference project, but further research could alter that opinion. The Caribbean islands are a case in point; with an estimated 44% share of the total cruise market. Alaska, another ecologically sensitive area, accounts for 7.9% and the Mediterranean, a semi-enclosed sea, 12.7% of the market [5]. The strain on the infrastructure of small towns, islands and island groups has in some cases reached acute levels, particularly in the Caribbean and the south Pacific, where efforts are being made to identify strategies that will reduce the environmental impact of increasing number of cruise ship visits. The United Nations Environmental Programme on Small Island Developing States (SIDS) has highlighted the problems being faced by these environmentally and ecologically vulnerable countries and is investigating sustainable solutions [6]." (Butt, 2007)

Waste and pollution

Pollutants and waste from cruise ships include air emissions, ballast water, waste water, hazardous waste and solid waste. It is estimated that an average cruise ship will generate a minimum of 1 kg of solid waste plus two bottles and two cans, per passenger per day and an average of 50 ton of sewage (black water) per day. A figure of 2,5 kg/passenger/day is quoted by the IMO, streamed as oil, hazardous waste, black water (sewage), grey water (wastewater), solid waste and air pollution. (Butt, 2007)



Figure 8.4 Wastewater emission of MSC Lirica on 13.10.2006. in front of Old port of Dubrovnik. UNESCO heritage site. Source dr. Adam Benovi (Carich and Mackelworth, 2014)

- Oil

It is estimated that a cruise ship generates 8 tonnes of oily bilge water for every 24 h of operation.

- Hazardous waste

A cruise ship carrying 3000 passengers can generate up to 68 litres of photo-chemicals per day.

- Black water (sewage)

It is estimated that cruise ships generate between 20 and 40 litres of black water per person per day dependent on passenger numbers.

- Grey water (wastewater)

It is estimated that cruise ships generate between 120 and 300 litres of grey water per person per day.

- Garbage (solid waste)

Approximately 50–70 tonnes of solid waste can be generated each week by a ship carrying 3000 passengers.

- Air pollution

Whilst it is not generally classified as a ‘true’ waste stream, air pollution is a major by-product of all ships and is relevant to the impacts cruise ships have on the environment. For economic reasons many vessels use heavy fuel oil, which has very high sulphur content (90% higher than petrol or conventional diesel). The emissions from burning this type of fuel include high levels of nitrogen oxide, sulphur dioxide, carbon monoxide and hydrocarbons [10]. Some cruise ships are now looking at alternative, cleaner types of engines and fuels, particularly gas turbines which are very efficient and have low emissions. Cruise ships have a continuous need for ancillary power to meet lighting and ventilation demands both at sea and in port, which is provided by the ship’s generators. Due to technical constraints, such as phasing and high demand, it is not always possible for ships to operate from a shore power supply, so generators must be run constantly whilst in port which adds to the local environmental burden. Emissions also occur through the incinerator flue gases, particularly if plastics are burnt when dioxins, furans and other heavy metals can be released into the atmosphere. It should be noted that the EU has recently published a Recommendation (2006/339/EC) that promotes the use of

shore-side electricity by ships at berth in EU ports specifically to address issues of air quality and noise pollution at berths located near residential areas.

Figure 8.5 A case of soot discharge was recorded on camera by local person in Dubrovnik in 2009, and that is rarely publicly available information on air pollution malpractice. (Caric and Mackelworth, 2014)

Waste policy



Literature stresses the need for proper waste facilities in the ports of call or home ports. The need of local policy is emphasized giving more importance to the future stakeholders. As discussed earlier, it is clear that any cruise home port or port of call should provide adequate waste management facilities to cope with the volume of waste generated by these vessels. How ports deal with this waste will be closely linked to local policy pertaining to land generated waste and to the facilities available to them. Local port policy will, to an extent, also influence how waste is managed on board (Butt, 2007). "Most developed countries now use the waste hierarchy in order to encourage a more sustainable approach to waste management. The most desirable option within the hierarchy is reduction (preventative), re-use and recycling (ameliorative

and preventative), finally end use disposal (assimilative). The waste hierarchy has worked well in the past, particularly through increased levels of recovery, recycling and re-use, but there is a growing need to take into account the environmental, social and economic impacts of waste strategies based on the hierarchy, where interpretation of the adage 'prevention is better than the cure' may be seen as the next step to achieving sustainability [9]." (Butt, 2007)

The aforementioned statement that strong regulation on environmental impact of cruise ships can function as an incentive to alter the status quo of cruise tourism can be confirmed. "Some of the larger operators advocate and encourage high levels of environmental awareness and advertise this fact as an additional incentive when selling their cruises [5]. The ICCL have developed an Industry Standard for 'Waste Management Practices and Procedures', which all members have agreed to incorporate into their Ship Management Systems (part of the ISM Code); compliance with this standard will assist in enhancing present cruise ship waste management." (Butt, 2007) This indicates that local policy indeed can have a positive influence on the environmental impact of cruise ships.

Best practices

Alaska, responsible for 7.9% of the total cruise market, has already passed a federal law that implements very strict controls on waste disposal and pollution management for all vessels visiting the area. They closely monitor vessels for any infringements and have imposed large fines on operators who do not comply with this legislation. This initiative has led to the development of the federal Clean Cruise Ships Act, 2005, to legislate against discharges of grey water, sewage and bilge water by any cruise vessel within US territorial waters. (Butt, 2007) This case should serve as an example of proper implementation of cruise tourism in a vulnerable eco-system.

Costa Rica is a Caribbean country that approaches tourism in a more sustainable manner since 1987. Interesting lessons to be learned is that just like Cuba, it had similar assets (health, education, infrastructure). Tourism is organized nature based, locally owned (little foreign investment) and responsive to market trends and grounded in sustainable practices. Both the government and private sector take responsibility. Ever since cruise tourism has remained a minor sector and Costa Rica, welcomed

seven times more tourists and simultaneously doubled the earnings per tourist. (Honey, 2016)

7. Environmental analysis

The environmental state of the bay will need to improve if the bay indeed meets the required improvement of quality of water, flora and fauna in the bay area. This analysis will discuss the environmental pollution in the case of the bay of Havana. The full version can be found in the appendix.

7.1. Definition

Pollution is the introduction of a contaminant in an environment, causing instability, disorder, harm or discomfort in an ecosystem, in the physical environment or a living being; It is a negative alteration of the initial state of the medium, and usually generated as a consequence of human activity, when the generated pollutant load exceeds the treatment capacity in which it is poured. There are many causes that can cause it, the main which may be mentioned and which are common to find in an urban context are:

- Insufficient coverage of treatment of liquid waste and inefficient operation of existing systems.
- Final disposal of contaminated surface currents, land and marine waters, and sewage systems and storm drainage liquid and solid wastes
- Insufficient drainage system or interconnection to it, sewerage
- The emissions of polluting gases many of greenhouse gases, mainly CO₂ and CO, for stationary and mobile sources.
- Deterioration of housing stock
- High population density
- Poor water supply
- Atmospheric pollution.
- Noise pollution.
- Deforestation.
- Inadequate management of municipal solid waste, including hazardous and inert. (Melorose et. al., 2015)

7.2. Bad practices

Known sources of pollution are both domestic and industrial.

- Domestic

Because the city's separated drainage and sewage system is in practice not functioning, mixed waste water including feces is directly discharged in the bay area. This is a difficult problem to tackle, since replacing the city's wastewater infrastructure would be very costly. Therefore wastewater installations are being built along the perimeter of the bay.

- Industrial

The pollution in the bay has been an ongoing challenge over the past decades as it has been considered the most polluted in the Caribbean region. Therefore, since 1998 a sanitation has started by "characterization" of polluting sources. It is known that 124 industries considered "aggressive" environmentally and 53 were marked as "highly polluting". Although 41 facilities are allocated in the budget financial resources to take advantage of waste, only 64 percent of the total implemented such actions. (GTE-BH) (Cubadebate, 2016; Redacción IPS Cuba, 2014)

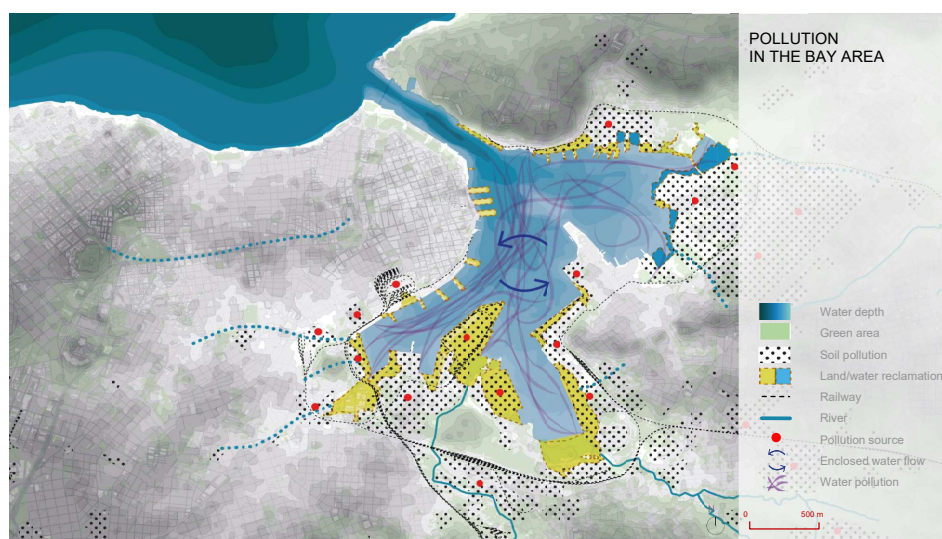


Figure 8.6 Pollution in the bay area of Havana (Canazzi et al., 2016)

7.3 Good practices

Among the good practices is the implementation of actions and stability Productions cleaner (PML) in 57 of the 106 entities that pay taxes to the basin, said Gzegotzewski.

Another experience is successfully applied in the Military Industrial Company Granma, ship repair, where the work of environmental coordinators has improved hygienic conditions and organization that prevent discharges to the bay. Among the measures taken were from workshops, creating a ship to the tank blasting away from the coast, grease trap cleaning up the replacement of detergent used in the kitchen for a less aggressive and biodegradable.

Another novelty is the pollution tax, which became operational in the last quarter of 2014. The tax increases as the levels of pollutants emitted by the company rise. The money earned by this concept will serve to reverse the current conditions of the roads. (Redacción IPS Cuba, 2014)

7.4. Results

“From the results, we can see that the amount of environmental damage falls into two categories: a) small-scale environmental destruction committed by individuals through illegal hunting, deforestation, dumping of waste into aquatic ecosystems, etc.; or b) large-scale environmental destruction resulting from major projects and industries approved by governmental agencies and owned by international companies, like hotel chains and mining companies after the Special Period, and agriculture before the Special Period.” (Maal-Bared, 2006)

7.5 Nuance

In order to provide insight in the environmental state of a country a comparative environmental risk assessment (CERA) can be executed as shown by (Maal-Bared, 2006). This tool can be used by governments and organizations to prioritize the resources (e.g. money, time) on tackling environmental problems. However, Maal-Bared speculates that the Cuban government will not look into setting environmental priorities using the results of this CERA due to several reasons. First of all, many of the decisions that were made by the government are irreversible. Contracts have been given to mining and tourism companies in a time of need when

not much consideration was given to what is environmentally friendly. Secondly, many of the methods that could be used now to reduce negative environmental consequences of some activities would be costly and resources are scarce. (Maal-Bared, 2006) The example also puts the possible impact of our study into perspective.

The article also addresses one interesting notion regarding the prevention and awareness of environmental problems. As mentioned one of the main priorities for the GTE-BH is education. Again it shows the additional challenges of operating environmental improvement programs in such a complex environment. "Some authors (Houston, 1998; Scanavis and Sarri, 2004) make the claim that environmental awareness would solve the Cuban environmental degradation problem. This claim largely fails to address the reality of the situation. Even if public environmental education resulted in the compliance of individuals (which in itself is questionable considering the scarcity of resources), the major sources of the current environmental crisis in Cuba are the mining and tourism industries, which are controlled by the government. So for example, convincing a local community to provide local guides for eco-tourism projects might decrease the negative impacts of tourism on the bio reserves and increase environmental awareness, as it did in Puerto Rico (Jacobsen and Robles, 1992). It would not decrease the destruction caused by the construction of tourist facilities, transportation of tourists to the sites, and attempting to accommodate a new industry in a region that lacks the necessary infrastructures." (Maal-Bared, 2006)

"It is unclear whether the failings of governmental policy are due to time delays, lack of resources, lack of infrastructure, or the fact that Cuba's environmental issues are not on top of the priority list right now. So far, the Cuban government has made some "environmentally correct" decisions in the fields of agriculture and ecology. (Maal-Bared, 2006)

8. Climatology analysis

"The Cuban climate is tropical and temperate with cool trade winds to provide relief from the heat and humidity. Havana's weather is typical for Cuba; it is generally sunny and hot year round apart from when it is stormy, which is why it is considered a year-round tourist destination. There is not much variation between day and night temperatures along

the coast, and average sea temperatures are 77°F (25°C). The rainy season, from May to October, is also the hurricane season, but most hurricanes strike between August and October, while the wettest months in Havana are May and June. Hurricanes are usually more of a problem on the south coast of Cuba and Havana is typically safe from the worst of the tropical storms. Summer temperatures average around 81°F (27°C) with humidity at about 80 percent. Temperatures of about 68°F (20°C) are normal in winter. The temperature very seldom drops below 50°F (10°C) in Havana. The most popular time to visit Havana is in the winter months of December and January but, although avoiding the hurricane season is probably wise, Havana’s weather is pleasant for travelers all year.” (Globe Media Ltd., 2016)

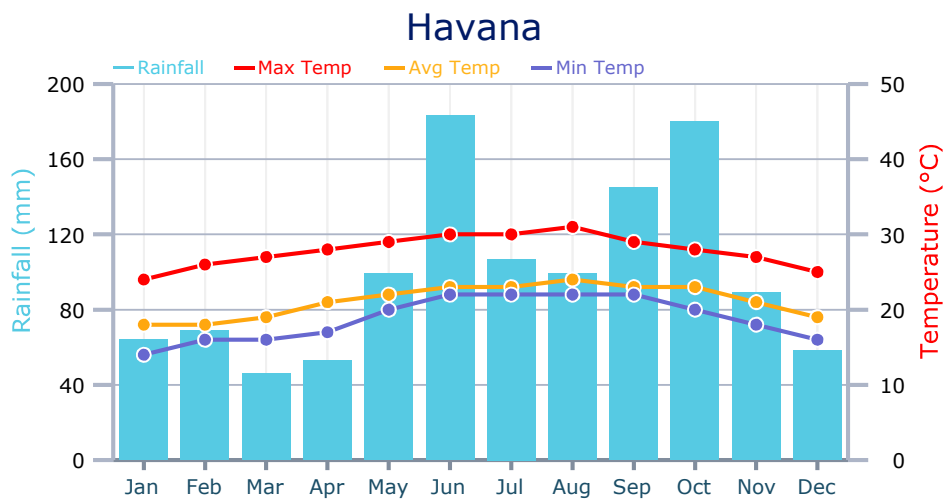


Figure 8.7
Climatology of
Havana (unkown)

8.9 Reference projects

Learning from similar projects can be a fast and effective way to find solutions for a project. In this paragraph the report discusses a handful of projects with similar characteristics. Investigating transition of ports showed that the majority of transitions consist of (former) city ports that (partially) left their industrial activities or managed to incorporate more social and environmental aspects and now serve different purposes. Because of this reason it is interesting to review in a later stage if this framework developed for the port of Havana could also be applicable to other ports. A list of the reference projects is presented here; the remaining information is left for the appendix.

Transformed city ports

- Amsterdam, NL
- Antwerp, BE
- Barcelona, ES
- Copenhagen, DK
- Dublin, IR
- Hamburg, GR
- Lisbon, PT
- Marseille, FR
- Thessaloniki, GR
- Rotterdam, NL (Maas- + Rijn- + Waalhaven)

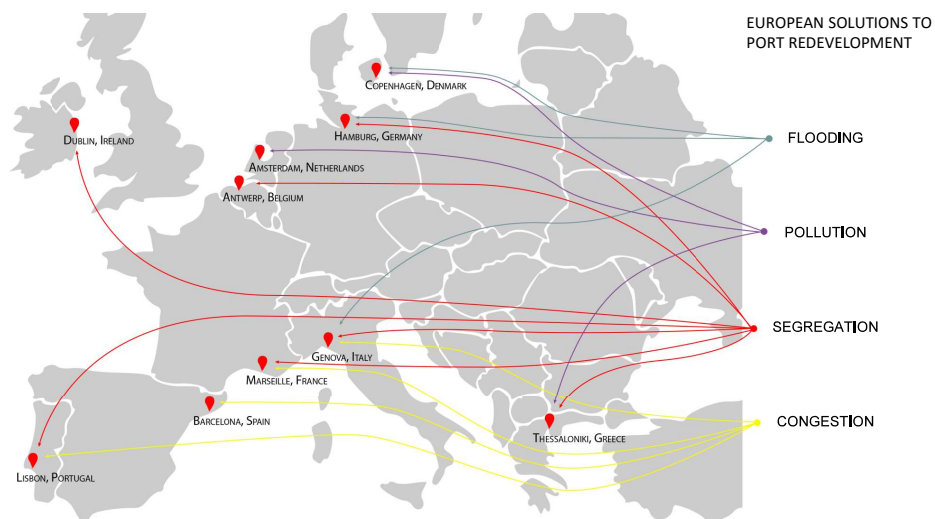


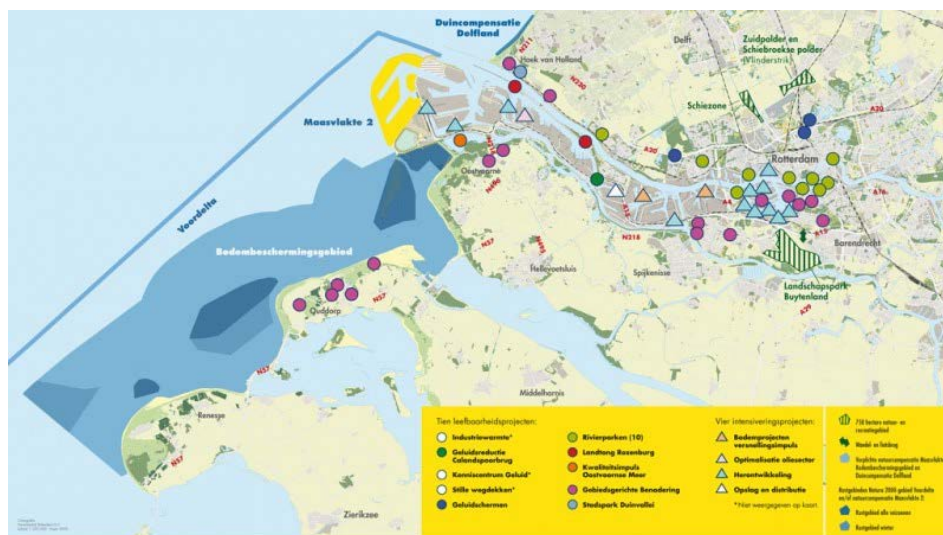
Figure 8.8 European solutions to Port Development (Canazzi et al., 2016)



Figure 8.9 Harbour bath in the (former) city port of Copenhagen (Vendana, 2012)

Other port developments

- Cork, UK
- Qingdao, CN
- Rotterdam, NL
- Maasvlakte 1 & 2
- Los Angeles & Long Beach, US
- Sydney, AU
- Dubuque, US
- Tema, GH
- Vancouver, CA



*Figure 8.10
Maasvlakte 2.
The expansion
of the port of
Rotterdam occurs
simultaneously with
the incorporation
of environmental
and social project
(Rotterdam
Port Authority,
2008)*

8.10. Additional analyses

Additional analyses that can be relevant can be found in the reference report (Stam et al., 2013). This includes: hydrodynamics, infrastructure, nautical situation, finances, economics and project planning.

1. Introduction

This chapter describes the next step in the framework and tries to answer the question: which of elements of the remaining bay are Essential (must-have), Preferable (nice-to-have) or Unnecessary for a transition of the bay of Havana? The chapter will indicate the 'elements' and label them with one of the three aforementioned statuses. An element in this context can be a specific company, location or construction, but also more general feature like scenery, ambiance. The complete analysis can be accessed in Appendix K.

2. The elements

The elements will now be presented with a short description and their subsequent status. The harbour consists of five main areas: the entrance channel, Marimelena, Guasabacoa, Atarés and the central zone.

The letters in the figure 9.1 refer to the elements listed below. The full list including background information can be found in Appendix K. The criteria for these statuses are in line with the criteria that apply for the entire framework and are discussed earlier in this report. Grounds for labeling something 'Essential' or 'Preferable' can be either economically, culturally, environmentally. It must be noted that this is a subjective approach and decisions are made based on the information provided in the previous chapter.



Figure 9.1 Overview of the bay area, the elements and their labels ((Google, 2016); own work)

Companies and industries

- Powerplants
 - A. Regla powerplant
 - B. Tallapiedra powerplant
- C. Oil refinery Níco López
- D. Container terminal
- E. Bulk and break-bulk terminals
- F. Ro/Ro terminals
- G. Cruise terminal
- Shipyards
 - H. Marimelena
 - I. Navy's shipyard
- J. Businesses in Havana Vieja
- K. Anchorage areas

Construction and infrastructure

- L. Tunnel under entrance channel
- M. Train station Casablanca
- Ferry terminals
- N. Regla
- O. Casablanca
- P. Havana Vieja

Cultural

- Q. Havana Vieja and its fortification system
- R. Central train station
- S. Regla Church

Scenery and environment

- T. Waterfront Havana Vieja
- U. Rivers
- V. Wetland Tricornia (Humedal Tricornia)
- W. Fishing harbour
- X. Natural banks

10. Step 3: Define project must-haves and should-haves

64

1. Introduction

In this framework the project goals, i.e. must-haves and should-haves, are determined in the third step (Vliet, 2008). This is different approach than conventional port planning since normally the goals determined at the start of a project. This chapter will determine these goals and despite some lacking information they will be presented as concrete as possible. It is known that for this study there is no possibility to test all goals. Nuances about these goals and additional information can be found in the appendix.

2. Goals

The goals have to meet the criteria of the framework, discussed in chapter 'Alternative Port Planning Methods'. 'A sustainable port is a port which has achieved and is maintaining a balance in economic, environment and social extent for the surrounding region whilst using a long-term vision to anticipate on future developments and the needs of future generations. A sustainable port uses the Earth's resources for its own benefit without affecting its capacities for future generations.'

3. Must-haves

- Create an equitable, viable and bearable port in order to be sustainable and embrace flexibility (fig. 10.1).
- Focus on tourism on local industry and businesses as main functions. (Chase, 2016; McMahan, 2016; Miller, 2016)
- Improve environmental impact.
- Maintain regulations for vessels to reduce their impacts (waste, operational and use impacts) and provide the facilities for vessels and operators. (Butt, 2007) ((WPCI), 2015)
- Maintain regulation on (remaining) polluting parties. ((GTE-BH), 2015)
- Find a balance between (allowed) amount of tourists and available infrastructure. (Miller, 2016)
- Ensure active stakeholder and citizen involvement
- Ensure clear responsibilities for concerned parties



Figure 10.1 Including Social, Environmental and Economic aspects (unknown)

4. Should-haves

- Preserve the characteristics of the natural bay and its historic content. (Honey, 2016)
- Encourage Brownfield development. (Leger et al., 2016)
- Create a mix between large, middle and small-sized companies
- Encouraging entrepreneurship. (Honey, 2016)

11. Step 4: Develop alternative designs

1. Introduction

In this chapter four design proposals will be presented, one for each scenario. These designs have to be interpreted as a hypothetical projection of the development of the bay since very detailed designs is beyond the scope of this study. A summary of the reference design is also presented to give an impression. The entire reference design can be found in (Stam et al., 2013). Every of the designs will be compared to the must-haves and should-haves determined in the previous chapter.

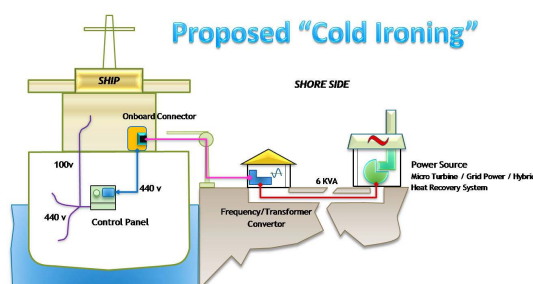
2. Reference project

The design of the reference project consists of a general masterplan and a more detailed description of a marina, ferry terminal and supporting infrastructure. Instead of presenting the entire design, solely relevant observations for the purpose this study will be discussed.

- The design by Stam is exclusively focused at the elements that have to be designed: the marina, the ferry terminal and a part of the surrounding infrastructure. Incorporation of the design in the (urban, social and natural) environment is not included.
- Exclusive yachting clubs and luxurious vessels indicate that Havana would chose for upper class tourism. This might create a large discrepancy with the local citizens. It is not mentioned how this would relate nor how local citizens would benefit from it.
- Unfortunately specific information about the required or proposed capacity is lacking. Fortunately some flexibility is proposed to be incorporated as only one pier of the ferry terminal will be built at first and for the marina this is also incorporated. This is positive as cruise tourism is a relatively new affair for Havana and tourist predictions might be inaccurate (V, 2013)
- The masterplan leaves little room for local economic development.
- In the MCA, sustainability is not included as a criterion whatsoever. Even though environmental aspects are difficult to accurately incorporate in an MCA, it can give an impression for the decision making process.
- There is nothing mentioned about the expected vacancy of terminals since companies are expected to leave the bay area. This terrain could possibly also be re-used for further development of harbor related activities such as the terminal or marina.

- No measures are taken to improve the environmental status, which is desired by the government.
- Stakeholders are not involved in the development of the project.
- Facilities for reducing environmental impact of ships are not sufficient. 'Sewage and waste water pump out' and 'Garbage collecting service' are the only facilities mentioned. Shore power (or cold ironing) is not included (fig 11.1)

Figure 11.1
Scheme of
"cold ironing"
or shorepower
(source unknown)



3. Design #1

Large influence climate change, centralized government.

The design would likely resemble the reference project to a large extent, including the lack of stakeholder involvement. The government would allow for little time to design and would be in control of almost every part of the (state-owned) project. By using the framework, however, some differences can be expected (fig. 11.2).

- Flexibility measures are relatively easy to incorporate
- Some sustainability measures like shore power can be implemented and depending on the economical necessity, a limitation in tourist influx.



4. Design #2

Large influence climate change, privatized government

Again the incentive to act is high due to climate change, but a privatized government would give more room to secondary parties, such as cruise operators, multinationals, (polluting) industries in the bay and environmental organizations. It will be a challenge since a shared responsibility project is not common practice in the current society. The workgroup of the government has more responsibility to manage these groups and has to prevent an influx of tourists, which cannot be hosted, by the city (fig. 11.3)

- More stakeholder involvement
- If tourism is profitable, the interest for cruise tourism might increase to an extent that Havana cannot deal with.
- The privatized situation gives more responsibility to the workgroup to 'connect all the dots'. For instance, the infrastructure needs to be connected by many different parties and there is a close link between the capacities, costs and impact on the urban and environmental level. The historic center and neighborhoods around the bay area might experience a large influx of foreign capital while historic, cultural, social or environmental interests are easily neglected.

Google Maps

Design #2
- Bay of Havana -



5. Design #3

Small influence climate change, centralized government

Regarding the outcome of the project, this might be a preferable situation as Cubans are familiar with a centralized government and the small influence of climate change allows for more time in the preparation of the project. If the government truly aspires a sustainable development of the port, this should be possible (fig 11.4).

- Stakeholder involvement has to be encouraged, although this is uncommon in the current socialistic Cuban society.
- Opportunities for brownfield development can be explored

6. Design #4

Small influence climate change, liberal government.

A liberal approach to the bay area in combination with a small impact of climate change would allow for more the stakeholder involvement, but might lead to conflicts because of the shared responsibilities. Many of the must-haves and should-haves could be incorporated if the government somehow manages to regulate the development (fig. 11.5).

- Some environmental regulation possible
- Space for development of private sector.

12. Step 5: Test the alternatives

Testing the alternatives quantitative would have to be done by means of simulation. This could be done by, among others, a cost-benefit analysis, hydraulic simulations, traffic flow models, etc. In the reference project, many of these models already have been built and tested. Although it would be useful to do conduct further research on the alternative designs, this is beyond the scope of the current study. Furthermore, it would require more data that is currently not available. This will therefore be recommended for future research on this topic.

13. Step 6: Evaluate the alternatives

1. Introduction

Since the designs represent estimated projections of extreme scenarios and simulation of the designs is beyond the scope of this study, the evaluation will be done qualitatively. It will be discussed how feasible the framework is in reality, and how/which circumstances influence this process. As written in the previous chapter, we will refer to the reference project as this has been evaluated qualitatively already.

2. Climate change

If heavy storms like the one in 2015 will hit Havana more often in the future, the urge to intervene in the city's infrastructure will be more likely be supported by the general opinion (Alex Wellman, 2015). This implies that with severe influence of climate change there would be a need for investment to fund the constructions on infrastructure. Industries that are easy to develop for fast economic gains, such as tourism, would be a way of doing so. For instance, hosting cruise ships in the bay of Havana would be an easy solution as the infrastructure already (partially) allows for it.

With severe effects of climate change a long decision making process would be unfavorable, the focus for the decision making process would be on (short-term) economic gains. Little influence of climate change allows for more time in the process to develop an integral approach that serves both economic, environmental and social aspects.

3. Politics

Cuba's society is currently organized around a centralized government and it might hold on to this approach. Interestingly, some

aspects that are important to Cuba's government, such as healthcare and education are of very high standards. (InterNations, 2016). This indicates that is possible for the Cuban government to reach goals such as a sustainable transformation of the bay of Havana if the government truly desires to. Cuban society is not used to a liberal approach with shared responsibilities from private parties or citizens. We will assume this would bring more influence of private companies in the decision making process. Considering that the bay is mostly interesting for tourist companies or multinationals (since other industries will have to leave port), these parties might gain more influence, which is not necessarily a positive development regarding the sustainable outcome of the project. We conclude therefore the following

If a centralized government aspires a sustainable outcome of the transformation of the bay, it will have more power to control the outcome of the project than a decentralized government. However, early and active stakeholder involvement is more likely to expect from a liberal approach.

4. Reality

The reality will likely be a situation that lies in between these extreme scenarios. From these scenario's we will now estimate which aspects mentioned in the designs are likely or unlikely to be implemented in a real design.

Likely to be implemented

- Flexibility measures in larger projects
- Stricter regulations on polluting parties
- Preserve cultural and current natural characteristics
- (small-scale) entrepreneurship
- Brown field development
- Infrastructure improvement

Unlikely to be implemented

- Limit on tourist influx
- Strict environmental regulation on cruise ships
- Sufficient public transportation
- Active and early stakeholder involvement
- Mixture of company sizes and industries

14. Step 7: Create the final design

74

1. Introduction

After reviewing the alternatives, we will now discuss the final design. This design should be interpreted as an advice for the responsible port planners of Havana (the 'workgroup') on how the transition of the bay could take place. It therefore serving as the ideal outcome, although acknowledging the high influence that for instance politics and climate change can have on the outcome of the design.

2. Spatial outcome

The spatial outcome of the design resembles the second design to a large extent, except for less room for industrial areas and a mixture of public and private (tourist) industry along the perimeter of the bay. The water basins in the bay should be protected and environmental regulation can achieve the preferred goals for water quality. Furthermore the government should refrain from extravagant tourist development and cherish the natural character of the bay. The large areas of abandoned port industry can be used to develop the tourist industry and stimulate local entrepreneurship.

Google Maps

Final design
- Bay of Havana -



Figure 14.1
Final design - spatial
outcome (own work)

3. Criteria

Besides the spatial division, the criteria that were mentioned earlier in the chapter should also be considered. These are the following

- **Economics**

A mere focus on tourist industry is discouraged. In stead, a more diverse economical development of tourist industry and local entrepreneurship is recommended.

- **Social**

Including stakeholders in the design process is very important. The assumed standpoints of the stakeholders should be investigated and early and active stakeholder involvement should be pursued.

- **Environmental**

Cherish the natural character of the bay and use local policy to regulate water discharges in the bay. National policy should regulate the larger industries such as (cruise) tourism.

- **Governance**

A clear distinction of responsible parties for the design, construction and maintenance phase should be made. Paradoxical goals should be avoided.

- **Green-/Brownfields**

Due to the large amount of areas of previous port industry that will become available in the near future, possibilities for Brownfield development will arise.

- **Location**

The port has to host several functions. These function should be appointed to their location in an “opportunity-driven” fashion.

- **Flexibility**

The entire design should merely function as a best estimated solution for the time being. The future developments are highly uncertain and therefore the design should be flexible. This could for instance be done by phased construction or multi-functional use of elements (e.g. piers, buildings). Furthermore, a continuous learning process should encourage an ongoing adaptive port layout and stimulate innovation.

- **Innovation**

An incentive for innovation can be encouraged through local policy. This is for instance applicable for cruise vessels, which might be restricted unless they meet certain sustainability demands regarding pollution.

1. Introduction

This report makes an attempt to address the little knowledge about ports in transition along with an attempt to improve the transition of the bay of Havana by means of developing a framework. The second part of this report – the case study - can be interpreted as a first iteration to test the proposed framework. Evaluating this step is important to determine which adaptations should be made and what further research has to be conducted. If the framework manages to serve a general range of port transitions, it would be possible to use this framework for other ports as ports are globally facing similar transitions. However, due to the specific, isolated political and economical situation, this is not the mere intention of the report. Two parts are evaluated: design and framework.

2. Evaluation

2.1 *Design*

As can be seen from table 14.1, the adapted port planning seems to serve important aspects of the aforementioned criteria that the framework needed to serve. However, the framework cannot meet all requirements. More concrete research would have to be done with respect to modeling of future models and to economic and financial uncertainties. No alternative for deterministic risk assessment is at hands, a cost benefit calculation is not executed (however, recommended for further research).

2.2 *Framework*

The framework served as a guideline to come to an improved design compared to the traditional approach. However, it was the first iteration of the framework and the following points should be considered for further research or implementation.

- **Time**

The application of the framework requires a lot of time invested, especially in the first step: understanding the system. Principally, understanding the system can always be expanded into new fields and insights. Considering that most projects have a limited amount of time available, it is important to determine where to finish further research on the system.

Table 15.1 Evaluation of traditional vs. alternative port development

| Criteria | Traditional approach | Alternative approach |
|--------------------|---|--|
| Based on | - Reference and workgroup projects (Stam et al., 2013) ((PID-BH), 2014) | Ports in Transition framework |
| Economics | - Focused solely on tourist sector - Deterministic risk assessment (e.g. climate change models) - Cost benefit analysis executed | - Focus on tourism and local economy - No alternative for deterministic risk assessment - No cost benefit analysis executed |
| Social | - Main stakeholders are included in the decision making process - Isolated project area, little connection with surrounding neighborhoods | - More inclusive approach towards stakeholders. Larger focus on the concerns of opposing parties - Project area aspires social inclusion. |
| Environmental | - Environmental aspects in some regards inferior to economic aspects. Project design seems to be inconsistent with environmental goals of the government. | - Strong focus on improving the (neglected) environmental state of the bay and the goals of the government through (inter)national policy. |
| Governance | - Unclear division between decision making/operational/designing/constructing parties. | - Responsibilities highly dependent on stakeholders' outcome, i.e. the future (political) scenario. |
| Green-/Brownfields | - Strong focus on Greenfield development | - Possibility to incorporate more Brownfield development. Dependent on governance. |
| Location | - Location of design based on decision by client, typical for traditional design process (function driven) | - Location of services determined after extensive analysis (opportunity driven) |
| Flexibility | - Focus on flexibility in design - Investment based on return of investment | - Attempt to incorporate additional flexibility measures in the design - Continuous learning encouraged by building in phases |
| Morphology | - Extensive morphological analysis | - No additional morphological analysis |
| Innovation | - Innovation not specifically encouraged | - Innovation highly encouraged by restrictions on passenger numbers, pollution by vessels, emissions, etc. International reward system like current ESI ((WPCI), 2015) |

- Resources

Despite an alternative approach and the knowledge that traditional methods such as risk assessment, decisions of investment and cost-benefit-analysis have a deterministic approach, no decent alternatives can fully replace these tools. Therefore every project will have to decide whether or not to use these kind of traditional tools.

- Subjective character

In an attempt to refrain from quasi-objective tools, such as a MCA, this report relied on the subjective interpretation of the analysis of the first step of the framework. Although the outcome may be valued equally, it should be taken into account that the designer has a large influence. A factor that contributed to this subjectivity was the lack of concrete information from a client, since the demands from the Cuban government were merely interpreted from other sources.

16. Conclusion

1. Framework for a port in transition

Worldwide, sea ports are subject to an ongoing competition in terms of global economy. They face the challenge to either keep up with this trend by adapting to the increasing requirements (e.g. port facilities, infrastructure, handling capacity and speed, etc.) or to accept a loss in market share. Although the latter is far from preferable, some ports are inapt for this and are left no choice and as a result deteriorate and (eventually) can be left abandoned.

The cause of this partially lies in the way that ports traditionally are developed. Usually, the traditional design process merely takes economic and governmental aspects into account. Moreover this linear and deterministic design process leads to rigid designs that include little room for flexibility and future adaptations. Constraints with this traditional port development can be found among the following aspects.

- Location
- Flexibility
- Slow design process
- Mixed interest of decision making parties
- Method of decision
- Method of investment
- Risk management
- Social and environmental impact.
- Abandoned city ports serve as a paradigm of this development.

Besides the aforementioned economical incentives to alter the traditional port development, other external incentives include the UN Sustainable Developments goals, and (inter)national policies.

City ports – like the port of Havana – serve as a paradigm for this type of development. In many cities where the former industrial port started to coincide with the remaining public spaces of the city, the port has to transform. Although examples of such transformations are available, there seems to be no common clear opinion on how this transition should be organized. Therefore this thesis aspires to contribute to a better understanding of these processes by developing a framework for a port in transition, in this case Havana.

The framework for a port in transition is based on preceding research in the field of Greenfield port development. Important research includes Ecosystem Based Design Approach (Vrolijk, 2016), Integrated Sustainable Port Development (Zheng, 2016), Port of the Future (Schipper, 2015), The Flexible Port (Taneja, 2013) and research on Brownfields (Leger, 2016). This has lead to a proposal for a framework with the undermentioned steps. Since the information on the port is limited and the future is highly uncertain, this report introduces the use of scenarios that are composed by driving forces for change (EMU REFERENCE).

1. Understand the System
2. Prioritize remaining elements (Essential, Preferable, Unnecessary)
3. Evaluate project needs and objectives (and adapt them if necessary)
4. Develop alternative designs (optionally use future scenarios)
5. Test the design alternatives
6. Evaluate the qualities of each alternative
7. Create the final design

These steps have to be applied while serving the following aspects:

- A long-term vision
- Multiple perspectives
 - Economy
 - Environment
 - Society
- Economics
 - Investment
 - Risk management
- Governance and management
 - Continuous learning design process
 - Clear division between decision making parties
 - Method of decision
 - Previously developed land/ Brownfields
- Location
- Morphology
- Flexibility
- Innovation

2. Case study in Havana, Cuba

The port of Havana serves as a case study to test this proposed framework. Due to a tumultuous 20th century and recent development in terms of politics, economy and trade, the activity of the port of Havana is shifting towards the port of Mariel, which is appointed as Special Development Zone. Therefore the government appointed a work group that is in charge of the transition of the bay of Havana. Although the government does not release a lot of information regarding their intentions for the bay, it can be concluded ((GTE-BH), 2015, (PID-BH), 2014) that the goal is to use the port for the tourist industry while improving the quality of the water in the bay to safe swimming water standards.

In order to test if the proposed framework is preferable over the traditional approach, the steps are followed. This resulted in the following spatial outcome.



Figure 16.2 Spatial outcome of the final design (own work)

3. Recommendations

Since this report is the first attempt to apply the framework, additional research and improvement of the framework is recommended. Especially on the following aspects the framework may be revised.

- Time - especially the analysis (step 1) requires a lot of time. It is important to know where and when to stop.
- Resources - the framework still relies on traditional tools.
- Subjective character - although a subjective approach is not a problem per se, every project it should be decided if this is a preferable situation. Otherwise, traditional methods can serve as a solution, such as an MCA.

- (Collins) (2016)** Definition of framework. Available from: <http://www.collinsdictionary.com/dictionary/english/framework> (accessed 1 september 2016).
- (CUJAE) (n.d.)** Situación medioambiental zona protegida bahía de La Habana. Afectación al patrimonio por la contaminación atmosférica, terrestre y acuática. CUJAE.
- (DredgingToday.com) (2016)** Ringaskiddy Port Redevelopment Project Announced. Available from: <http://www.dredgingtoday.com/2016/01/07/ringaskiddy-port-redevelopment-project-announced/> (accessed 1 September 2016).
- (Ecoshape) (2015)** Building With Nature. Ecoshape, 2.
- (GreenPort) (2014)** The port of Cork's future plans for redevelopment. Available from: <http://www.greenport.com/news101/europe/the-port-of-corks-environmental-management-system-and-future-plans-for-redevelopment> (accessed 1 September 2016).
- (GTE-BH) (2015)** El pélicano de la Bahía de La Habana. El Pelicano, Havana, Cuba.
- (NWO) (2016)** Integrated and Sustainable Port Development in Ghana within an African Context. Available from: <http://www.nwo.nl/en/research-and-results/research-projects/i/95/13995.html> (accessed 1 September 2016).
- (PID-BH) (2014)** Proyecto Integral de Desarrollo Bahía de La Habana. Proyecto Integral de Desarrollo Bahía de La Habana.
- (PortofVancouver) (n.d.)** Sustainability. Available from: <https://www.portvancouver.com/about-us/sustainability/> (accessed 1 September 2016).
- (RotterdamPortAuthority) (2013)** Maasvlakte 1.
- (RotterdamPortAuthority) (n.d.)** Waalhaven-Zuid. Available from: <https://www.portofrotterdam.com/en/the-port/port-development/waalhaven-zuid>. (accessed 1 September 2016).
- (UNESCO-WHC) (2015)** Coastal protection Malecon seawall. Available from: <http://whc.unesco.org/en/list/204> (accessed 1 September 2016).
- (WaterfrontsNL) (2016)** Qingdao waterfront Re-Development. Available from: <http://www.waterfrontsnl.com/project-qingdao-china/> (accessed 1 September 2016).
- (WPCI) WPCI (2015)** Environmental Ship Index ESI. Available from: <http://www.environmentalshipindex.org/Public/Home> (accessed 1 September 2016).

(WTO) (2015) World Trade Report 2015. World Trade Report, techreport, Geneva, Switzerland.

Alex Wellman (2015) Havana floods: Torrential rain and high winds batter Cuban capital leaving three dead. Mirror, Available from: <http://www.mirror.co.uk/news/world-news/havana-floods-torrential-rain-high-5615103> (accessed 30 August 2016).

Archibold RC (2015) Inequality Becomes More Visible in Cuba as the Economy Shifts. The New York Times, 1–5.

Arecco P (2015) Port of Rotterdam, Adaptive Port Masterplanning for Europoort. TU Delft.

Balingit M (2016) In Cuba, as an uncertain future inches closer, it's still a step back in time. The Washington Post, Washington.

BBC (2016) Cuba legalises small and medium private businesses. BBC, Latin America, Available from: <http://www.bbc.com/news/world-latin-america-36375807>.

Berg N (2014) The Port of the Future Is Arriving in Los Angeles. Available from: <https://nextcity.org/features/view/alta-sea-the-solution-to-maritime-industry-decline-Los-Angeles> (accessed 1 September 2016).

Bridges TS (2015) Engineering with Nature. U.S. Army Corps of Engineerings (USACE), 2015(March 12).

Butt N (2007) The impact of cruise ship generated waste on home ports and ports of call: A study of Southampton. Marine Policy, 31(5), 591–598.

Canazzi A, Yun-Shih C, Fecianti, et al. (2016) Rethinking Havana - Constructing Sustainable Urban Landscapes. TU Delft, EMU.

Caric H and Mackelworth P (2014) Cruise tourism environmental impacts - The perspective from the Adriatic Sea. Ocean and Coastal Management, 102(PA), 350–363.

Caric H, Klobucar G and Ćtambuk A (2016) Ecotoxicological risk assessment of antifouling emissions in a cruise ship port. Journal of Cleaner Production, 121, 159–168.

Chase M (2016) Worsening Inequality for Afro-Cubans and Women. Boston Review.

Cork S, Bodell N and Ludicke M (2014) Masterplans for the development of existing ports.

Cubadebate (2016) Bahía de la Habana redujo contaminación entre 50 y 60 por ciento en último decenio. 1–6.

Den Ouden A (n.d.) De Rijnhaven. Available from: <http://web.archive.org/web/20061010194446/http://www.rotterdammers.nl/mens2/16.htm>

(accessed 1 September 2016).

Globe Media Ltd. (2016) Havana climate and weather <http://www.wordtravels.com/Cities/Cuba/Havana/Climate>.

Gonzalez E (2016) Cuba's Tourism Economy: The Boon and the Dilemma. AS/COA, Available from: <http://www.as-coa.org/articles/cubas-tourism-economy-boon-and-dilemma> (accessed 3 September 2016).

Google (2016) Bay of Havana.

Gross M (2016) A Record Breaking 3.1 Million Tourists Visited Cuba in 2015. Travel and Leisure, Available from: <http://www.travelandleisure.com/articles/tourists-visited-cuba-in-2015> (accessed 4 September 2016).

Grupo de Trabajo Estatal Bahía Habana (2016) Sitios Web Cubanos, Available from: <http://www.webcubanas.com/sitio-web/grupo-de-trabajo-estatal-bah%C3%ADa-habana> (accessed 1 September 2016).

Honey M (2016) Sustainable Tourism in Cuba : Lessons from the Region. CREST - Center for Responsible Travel, 23.

Indexmundi (2014) Cuba - International Tourism. Available from: <http://www.indexmundi.com/facts/cuba/international-tourism> (accessed 1 September 2016).

InterNations (2016) Healthcare and Education in Cuba. Available from: <https://www.internations.org/cuba-expats/guide/life-in-cuba-15677/healthcare-and-education-in-cuba-2> (accessed 16 September 2016).

IPCC (2014) Summary for Policymakers. Climate Change 2014: Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

Johnson D (2002) Environmentally sustainable cruise tourism: A reality check. Marine Policy, 26(4), 261–270.

Kautz EB, Nutter MA and Cochran T (2010) Brownfields Redevelopment : Reclaiming Land , Revitalizing Communities A Compendium of Best Practices. Communities, 5(November), 1–36.

Klein RA (2011a) Responsible Cruise Tourism: Issues of Cruise Tourism and Sustainability. Journal of Hospitality and Tourism Management, 18(1), 107–116.

Klein RA (2011b) Responsible Cruise Tourism: Issues of Cruise Tourism and Sustainability. Journal of Hospitality and Tourism Management, CAUTHE, 18(1), 107–116.

La Gasse LC, Van Rooij MIS, Smits BP, et al. (2015) Coastal protection Malecon seawall. Delft.

Laitamaki J, Tada M, Liu S, et al. (2016) Tourism Industry. 14(1), 7–29.

- Larsson N (2016)** Havana's dirty truths: rubbish-strewn streets spark anger at city's failings. The Guardian.
- Leger C, Balch C and Essex S (2016)** Understanding the Planning Challenges of Brownfield Development in Coastal Urban Areas of England. 7459(April).
- Ligteringen H (2012)** Ports and Terminals.
- Maal-Bared R (2006)** Comparing environmental issues in Cuba before and after the Special Period: Balancing sustainable development and survival. Environment International, 32(3), 349–358.
- Mariel I (2016)** Cuba 's free trade zone : a would-be capitalist enclave. 11–13.
- Mcmah L (2016)** Tourists in Spain facing a backlash from locals : ' Tourist go home ' Tourists in Spain facing a backlash from locals : 'Tourist go home'. News.com.au, 1–5.
- Middle Harbor Redevelopment Project (n.d.)** Available from: <http://www.middleharbor.com/> (accessed 1 September 2016).
- Miller G (2016)** Cuba shipping gains unlikely in the short term.
- PIANC (2011)** 'Working with Nature'. PIANC, (January).
- PIANC (2014)** 'Sustainable Ports' A guide for port authorities. (September), 64.
- Rathbone JP (2015)** Thaw in US-Cuba relations heightens business expectations. 5–9.
- Redacción IPS Cuba (2014)** Nuevas acciones para limpiar la Bahía de La Habana. Inter Press Service en Cuba, 1, 1–2.
- Roa I, Peña Y, Amante B, et al. (2013)** Ports: Definition and study of types, sizes and business models. Journal of Industrial Engineering and Management, 6(4), 1055–1064.
- Roberts D, Watts J and O'Carroll L (2016)** Obama appeals for economic revolution in Cuba with call to embrace free market. The Guardian, Havana.
- Rodrigue J-P (2016)** Modal Split of International Trade in Goods (\$ billion) 2000-2006. Hofstra University, Available from: <https://people.hofstra.edu/geotrans/eng/ch5en/conc5en/modalsplittradevalue.html> (accessed 5 September 2016).
- Romeu R (2008)** Vacation over: Implications for the Caribbean of opening U.S.-Cuba tourism. IMF Working Paper, Washington, U.S.A.
- Rotterdam M (2008)** Drijvend wonen in de Maashaven.
- Sangster S (2015)** An interdisciplinary design study of nature friendly banks made of residual material to enhance biodiversity in a port.
- Schipper DCA, Vergouwen MsS, De Jong DM, et al. (2015)** Port of the future.
- Stam G, Biezen T Van der, Kuhlman W, et al. (2013)** Tourist Port Havana.

Delft.

Taljaard S (2011) An implementation model for integrated coastal management in South Africa – from legislation to practice. (March), 199.

Taneja P (2013) The Flexible Port, Next Generation Infrastructures Foundation
Tiezzi S (2015) China, Cuba Seek Economic and Defense Cooperation. The Diplomat, 1, 2.

Tradingeconomics (2016) Cuba Tourist Arrivals. Available from: <http://www.tradingeconomics.com/cuba/tourist-arrivals> (accessed 1 September 2016).

Trotta D (Reuters) (2016) Cuba changing, but only slowly, since Obama's policy shift. Reuters, Available from: <http://www.reuters.com/article/us-usa-cuba-change-idUSKCN0WJ1DV>.

UNCTAD/RMT/2015(2015) Review of Maritime Transport. Geneva, Switzerland.

UNEP (2014) International Best Practices - Sustainable and Clean Port Program.

UNEP/GPA (2006) Ecosystem-based management- Markers for assessing progress. UNEP/GPA, the Hague, the Netherlands.

United Nations (2015) UN Sustainable Development Goals. Transforming Our World - the 2030 Agenda for Sustainable Development.

Vennix C (n.d.) Containers. Available from: <http://www.havenvakschool.com/www.HAVENVAKSCHOOL.com/STUKGOED-CONTAINERS.html>.

Vliet H van (2008) Software Engineering: Principles and Practice. third. In: Chichester, U.K.: Wiley.

Vrolijk EF (2015) Ecosystem-based port design: An approach for sustainable port development. (January).

Werlau MC (2014) The port of Mariel and Cuba-Brazil's unusual 'Medical' cooperation'. (January 2003), 1–34.

World Bank (2007a) Module 3: Alternative Port Management Structures and Ownership Models. Port Reform Toolkit.

World Bank (2007b) Port Reform Toolkit - The evolution of ports in a competitive world. Port Reform Toolkit.

Zheng Z (2015) Integrated Sustainable Port Design. (September).

Appendix A - Problems with traditional port planning

1. Introduction

This appendix will give more information of the concise enumeration of flaws of traditional port planning covered in chapter 3.

2. Location

One of the most important observations from traditional port planning is the lack of a proper analysis on the choice for a location. Usually, the port authority is in charge of the location selection whereas the design process is done by an engineering company. The different interests by these companies can result in a poor choice for the location regarding (for instance) social and environmental aspects. However, it can directly be mentioned that in the case of a transitioning port, this ability of location selection is hardly available. Only within the existing port or bay area is room for location selection of the different components of the design (Zheng, 2015).

3. Flexibility

This shift of awareness of the increasing complexity in which ports have to operate is a development that did come at a price. Many ports have encountered incorrect decisions. For instance, when the first container arrived to the port of Rotterdam in 1966, the layout of the port was not suited for this means of trade. Costly adaptations had to be made to prepare the available terrains. In hindsight, a more efficient port could have been created if the design allowed for this flexibility. Nowadays it is evident to create space for container trade, but again this does not come with any guarantee for future developments and demands. The development of uncertainty of port planning has only increased ever since. "Traditional port planning, comprising elements such as master-planning, infrastructure design, and project appraisal, focuses on short-term uncertainties. There are long distances between the economist preparing demand forecasts (on which the plans are based), the engineer doing the planning, the investment manager who sets up the business case, and the decision maker. The planners do not habitually think in terms of uncertainty, and therefore propose inflexible

plans and designs based on deterministic forecasts. The linear planning approach followed for most projects means that the decision-making cannot benefit from new information that reduces uncertainty. Investment appraisal involves a financial evaluation in a business case, and the selection among alternatives is based on expected values. Flexibility can enhance the value of a project, but cannot be valued with traditional methods. Decision making for a project facing multiple uncertainties on a single monetary value is likely to be misguided. The result is inflexible port layouts and infrastructure designs that are not functional under changing requirements. Clearly, a new approach is required.” (Taneja, 2013)

4. Long-term vision

“Due to the lack of uncertainty considerations, the objectives and sub-objectives of a port development are often not clearly defined. There is often no clarity in the short-term and long-term visions, which often leads to conflicting performance criteria that demand paradoxical solutions. The designers do not habitually think in terms of uncertainty and do not realize that flexible designs permit multiple pathways of project evolution, according to the scenarios that develop. The decision-making related to engineering (technical aspects) and (financial) investments is separated. The linear approach followed for most port development projects means that the decision-making cannot benefit from new information that reduces uncertainty.” (Taneja, 2013)

5. Method of investment

Traditional port planning and its subsequent traditional method of investment can also not grasp the uncertainty of the (long term) project development. “ The traditional methods of investment appraisal are based on a financial evaluation in a business case, using standard DCF methods. This is adequate for a stable environment, where the projects have deterministic requirements and the management has a clear strategy. For the majority of long-term projects, this is not the case. The decision-making is based on the most likely outcome of a situation, e.g., expected value of investment and potential revenues, which present serious drawbacks. These techniques

do not value flexibility in projects in order to justify its extra

cost.” “Since uncertainty is here to stay, we have to recognize it, prepare for it, adapt to it, manage it and finally, try to profit from it. Flexibility and adaptability will enable a port to develop strategies to adapt to current and future needs.” (Taneja, 2013)

6. Risk management

To investigate and elude risk, traditional project development comprises risk management and mitigation. However, due to misunderstanding of a clear definition of ‘uncertainties’ and the inability to adequately include uncertainties in the tools used to analyze the risk, current project development cannot foresee the true risks. “Project management literature assumes an environment in which the range of issues facing is more or less constant, and current quantitative trends can be extrapolated into the future. Project managers, in order to curb the negative effects of risks, often implement a risk management program, in addition to project management. Even so, these are treated as independent activities, and practiced in different time frames. Moreover, traditional risk management often tends to deal with uncertainties as certainties, purely due to a lack of common understanding regarding the definition of uncertainty (as well as a lack of suitable tools). Scope changes in a project contribute significantly to failure of a project, yet are not a part of standard practice of risk management.” (Taneja, 2013)

7. Social and environmental impact

However, there is more to it. Besides inefficiency or inadequate decisions due to the sluggish linear design process, (traditional) ports hardly serve social or environmental interests. Ports are often seen as an economically vital aspect of a society whereby negative impacts on the environment have to be accepted by all means. This image however is also a result of the way in which our ports developed throughout history. “The traditional seaports were built at a time when there was an exclusive focus on local trade, with often a characterized polluted industry, deficient transport, and little interest in public health, citizen welfare and no awareness for environmental issues. Early in the 20th century, the ports were characterized by high emissions as by contaminated emerging compounds emitted by local industry, vulnerable to poor water quality

and air pollution. Ports were concrete and steel ruled, and squeezed into the growing cities or cities grew out of wherever ports were put down. Moreover, during the industrial revolution ports created jobs attracting many people who settled in close vicinity of the port.” (Schipper et al., 2015)

It turned out that ports were not able to respond in a sustainable manner to the rapid economic growth. “Connections with the hinterland were not designed for rapid economic growth and so, with growing port volumes, the good flows were difficult to manage and there was a need to develop intelligent traffic management solutions (Port of Hamburg, 2012b). Ports could not cope with the rapid rise in international transport, since the unloading of cargo was done by hand and spurring the manufacture of small ships (Figure 1.2). Heavy industries and harbor activities created in general a negative impact on the ecosystem (De Boer et al., 2001; Bolam et al., 2006; Aloui-Bejaoui and Afli, 2012).” (Schipper et al., 2015)

Appendix B - UN Sustainable Development Goals

1. Introduction

Cuba is expected to develop towards a more open society with more room for (international) trade and the development of private initiatives. A more economic prosperous future lures as a beacon of progress. So why would Cuba worry about the sustainable development so much, if so many business opportunities and other profitable industries are currently developing.

Since October 1945 Cuba is also part of the UN. Part of the mission of the UN is the development of the UN Sustainable Development Goals (previous Millennium Development Goals) in order to transform our world towards a more sustainable future. In this thesis it is assumed that Cuba is in favor of this development and therefore is willing to try to meet the objectives of the goals. Obviously, the transformation of the bay of Havana is only a small project in comparison to these ambitious goals, but it could contribute to the ambition to meet the objectives.

The objectives where the bay of Havana can contribute to this bigger plan are the following. (United Nations, 2015)

2. Clean water and sanitation: Ensure availability and sustainable management of water and sanitation for all

- 6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all
- 6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations
- 6.3 By 2030, improve water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally
- 6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity

6.5

By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate

6.6

By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

6.a

By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies

6.b

Support and strengthen the participation of local communities in improving water and sanitation management

3. Decent work and economic growth: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all

8.1

Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 per cent gross domestic product growth per annum in the least developed countries

8.2

Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors

8.3

Promote development-oriented policies that support productive activities, decent job creation, entrepreneurship, creativity and innovation, and encourage the formalization and growth of micro-, small- and medium-sized enterprises, including through access to financial services

8.4

Improve progressively, through 2030, global resource efficiency in consumption and production and endeavour to decouple economic growth from environmental degradation, in accordance with the 10-year framework of programmes on sustainable consumption and production, with developed countries taking the lead

8.5

By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value

8.6

By 2020, substantially reduce the proportion of youth not in employment, education or training

8.7

Take immediate and effective measures to eradicate forced labour, end modern slavery and human trafficking and secure the prohibition and elimination of the worst forms of child labour, including recruitment and use of child soldiers, and by 2025 end child labour in all its forms

8.8

Protect labour rights and promote safe and secure working environments for all workers, including migrant workers, in particular women migrants, and those in precarious employment

8.9

By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products

8.10

Strengthen the capacity of domestic financial institutions to encourage and expand access to banking, insurance and financial services for all

8.a

Increase Aid for Trade support for developing countries, in particular least developed countries, including through the Enhanced Integrated Framework for Trade-Related Technical Assistance to Least Developed Countries

8.b

By 2020, develop and operationalize a global strategy for youth employment and implement the Global Jobs Pact of the International Labour Organization

4. Industry, innovation and infrastructure: Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation

9.1

Develop quality, reliable, sustainable and resilient infrastructure, including

regional and transborder infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all

9.2

Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries

9.3

Increase the access of small-scale industrial and other enterprises, in particular in developing countries, to financial services, including affordable credit, and their integration into value chains and markets

9.4

By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities

9.5

Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending

9.a

Facilitate sustainable and resilient infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, least developed countries, landlocked developing countries and small island developing States

9.b

Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities

9.c

Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020

5. Reduced inequalities: Reduce inequality within and among countries

10.1

By 2030, progressively achieve and sustain income growth of the bottom 40 per cent of the population at a rate higher than the national average

10.2

By 2030, empower and promote the social, economic and political inclusion of all, irrespective of age, sex, disability, race, ethnicity, origin, religion or economic or other status

10.3

Ensure equal opportunity and reduce inequalities of outcome, including by eliminating discriminatory laws, policies and practices and promoting appropriate legislation, policies and action in this regard

10.4

Adopt policies, especially fiscal, wage and social protection policies, and progressively achieve greater equality

10.5

Improve the regulation and monitoring of global financial markets and institutions and strengthen the implementation of such regulations

10.6

Ensure enhanced representation and voice for developing countries in decision-making in global international economic and financial institutions in order to deliver more effective, credible, accountable and legitimate institutions

10.7

Facilitate orderly, safe, regular and responsible migration and mobility of people, including through the implementation of planned and well-managed migration policies

10.a

Implement the principle of special and differential treatment for developing countries, in particular least developed countries, in accordance with World Trade Organization agreements

10.b

Encourage official development assistance and financial flows, including foreign direct investment, to States where the need is greatest, in particular least developed countries, African countries, small island developing States and landlocked developing countries, in accordance with their national plans and programmes

10.c

By 2030, reduce to less than 3 per cent the transaction costs of migrant remittances and eliminate remittance corridors with costs higher than 5 per cent

6. Sustainable cities and communities: Make cities and human settlements inclusive, safe, resilient and sustainable

11.1

By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums

11.2

By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons

11.3

By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries

11.4

Strengthen efforts to protect and safeguard the world's cultural and natural heritage

11.5

By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations

11.6

By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management

11.7

By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities

11.a

Support positive economic, social and environmental links between urban, per-urban and rural areas by strengthening national and regional development planning

11.b

By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, resilience to disasters, and develop and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels

11.c

Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials

9. Ensure sustainable consumption and production patterns

12.1

Implement the 10-year framework of programmes on sustainable consumption and production, all countries taking action, with developed countries taking the lead, taking into account the development and capabilities of developing countries

12.2

By 2030, achieve the sustainable management and efficient use of natural resources

12.3

By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses

12.4

By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment

12.5

By 2030, substantially reduce waste generation through prevention,

reduction, recycling and reuse

12.6

Encourage companies, especially large and transnational companies, to adopt sustainable practices and to integrate sustainability information into their reporting cycle

12.7

Promote public procurement practices that are sustainable, in accordance with national policies and priorities

12.8

By 2030, ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles in harmony with nature

12.a

Support developing countries to strengthen their scientific and technological capacity to move towards more sustainable patterns of consumption and production

12.b

Develop and implement tools to monitor sustainable development impacts for sustainable tourism that creates jobs and promotes local culture and products

12.c

Rationalize inefficient fossil-fuel subsidies that encourage wasteful consumption by removing market distortions, in accordance with national circumstances, including by restructuring taxation and phasing out those harmful subsidies, where they exist, to reflect their environmental impacts, taking fully into account the specific needs and conditions of developing countries and minimizing the possible adverse impacts on their development in a manner that protects the poor and the affected communities

7. Climate action: Take urgent action to combat climate change and its impacts*

13.1

Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries

13.2

Integrate climate change measures into national policies, strategies and planning

13.3

Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning

13.a

Implement the commitment undertaken by developed-country parties to the United Nations Framework Convention on Climate Change to a goal of mobilizing jointly \$100 billion annually by 2020 from all sources to address the needs of developing countries in the context of meaningful mitigation actions and transparency on implementation and fully operationalize the Green Climate Fund through its capitalization as soon as possible

13.b

Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities

*Acknowledging that the United Nations Framework Convention on Climate Change is the primary international, intergovernmental forum for negotiating the global response to climate change.

8. Life below water: Conserve and sustainably use the oceans, seas and marine resources for sustainable development

14.1

By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution

14.2

By 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their resilience, and take action for their restoration in order to achieve healthy and productive oceans

14.3

Minimize and address the impacts of ocean acidification, including through enhanced scientific cooperation at all levels

14.4

By 2020, effectively regulate harvesting and end overfishing, illegal, unreported and unregulated fishing and destructive fishing practices and implement science-based management plans, in order to restore fish stocks in the shortest time feasible, at least to levels that can produce maximum sustainable yield as determined by their biological characteristics

14.5

By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information

14.6

By 2020, prohibit certain forms of fisheries subsidies which contribute to overcapacity and overfishing, eliminate subsidies that contribute to illegal, unreported and unregulated fishing and refrain from introducing new such subsidies, recognizing that appropriate and effective special and differential treatment for developing and least developed countries should be an integral part of the World Trade Organization fisheries subsidies negotiation

14.7

By 2030, increase the economic benefits to Small Island developing States and least developed countries from the sustainable use of marine resources, including through sustainable management of fisheries, aquaculture and tourism

14.a

Increase scientific knowledge, develop research capacity and transfer marine technology, taking into account the Intergovernmental Oceanographic Commission Criteria and Guidelines on the Transfer of Marine Technology, in order to improve ocean health and to enhance the contribution of marine biodiversity to the development of developing countries, in particular small island developing States and least developed countries

14.b

Provide access for small-scale artisanal fishers to marine resources and markets

14.c

Enhance the conservation and sustainable use of oceans and their

resources by implementing international law as reflected in UNCLOS, which provides the legal framework for the conservation and sustainable use of oceans and their resources, as recalled in paragraph 158 of The Future We Want

9. Life on land: Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.

15.1

By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements

15.2

By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally

15.3

By 2030, combat desertification, restore degraded land and soil, including land affected by desertification, drought and floods, and strive to achieve a land degradation-neutral world

15.4

By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development

15.5

Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species

15.6

Promote fair and equitable sharing of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources, as internationally agreed

15.7

Take urgent action to end poaching and trafficking of protected species

of flora and fauna and address both demand and supply of illegal wildlife products

15.8

By 2020, introduce measures to prevent the introduction and significantly reduce the impact of invasive alien species on land and water ecosystems and control or eradicate the priority species

15.9

By 2020, integrate ecosystem and biodiversity values into national and local planning, development processes, poverty reduction strategies and accounts

15.a

Mobilize and significantly increase financial resources from all sources to conserve and sustainably use biodiversity and ecosystems

15.b

Mobilize significant resources from all sources and at all levels to finance sustainable forest management and provide adequate incentives to developing countries to advance such management, including for conservation and reforestation

15.c

Enhance global support for efforts to combat poaching and trafficking of protected species, including by increasing the capacity of local communities to pursue sustainable livelihood opportunities

10 Partnership for the goals: Strengthen the means of implementation and revitalize the global partnership for sustainable development

Finance

17.1

Strengthen domestic resource mobilization, including through international support to developing countries, to improve domestic capacity for tax and other revenue collection

17.2

Developed countries to implement fully their official development assistance commitments, including the commitment by many developed countries to achieve the target of 0.7 per cent of ODA/GNI to developing countries

and 0.15 to 0.20 per cent of ODA/GNI to least developed countries; ODA providers are encouraged to consider setting a target to provide at least 0.20 per cent of ODA/GNI to least developed countries

17.3

Mobilize additional financial resources for developing countries from multiple sources

17.4

Assist developing countries in attaining long-term debt sustainability through coordinated policies aimed at fostering debt financing, debt relief and debt restructuring, as appropriate, and address the external debt of highly indebted poor countries to reduce debt distress

17.5

Adopt and implement investment promotion regimes for least developed countries

Technology

17.6

Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism

17.7

Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on favourable terms, including on concessional and preferential terms, as mutually agreed

17.8

Fully operationalize the technology bank and science, technology and innovation capacity-building mechanism for least developed countries by 2017 and enhance the use of enabling technology, in particular information and communications technology

Capacity-Building

17.9

Enhance international support for implementing effective and targeted capacity-building in developing countries to support national plans to

implement all the sustainable development goals, including through North-South, South-South and triangular cooperation

Trade

17.10

Promote a universal, rules-based, open, non-discriminatory and equitable multilateral trading system under the World Trade Organization, including through the conclusion of negotiations under its Doha Development Agenda

17.11

Significantly increase the exports of developing countries, in particular with a view to doubling the least developed countries' share of global exports by 2020

17.12

Realize timely implementation of duty-free and quota-free market access on a lasting basis for all least developed countries, consistent with World Trade Organization decisions, including by ensuring that preferential rules of origin applicable to imports from least developed countries are transparent and simple, and contribute to facilitating market access.

Systemic issues

Policy and Institutional coherence

17.13

Enhance global macroeconomic stability, including through policy coordination and policy coherence

17.14

Enhance policy coherence for sustainable development

17.15

Respect each country's policy space and leadership to establish and implement policies for poverty eradication and sustainable development

Multi-stakeholder partnerships

17.16

Enhance the global partnership for sustainable development, complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support

the achievement of the sustainable development goals in all countries, in particular developing countries

17.17

Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships

Data, monitoring and accountability

17.18

By 2020, enhance capacity-building support to developing countries, including for least developed countries and small island developing States, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts

17.19

By 2030, build on existing initiatives to develop measurements of progress on sustainable development that complement gross domestic product, and support statistical capacity-building in

Appendix C – Sustainable design philosophies

106

1. Introduction

This chapter provides background information on the sustainable design philosophies studied in this thesis.

2. Definition of sustainable port

- Port of the Future

A definition of a sustainable or green port is one in which the port authority and port users pro-actively and responsibly develop and operate, based on an economic green growth strategy (PIANC, 2014). PIANC has emphasized with strength the need to develop a Working with Nature philosophy of designing and operating, waterborne infrastructure and stakeholder participation. Starting point is a long-term vision on the area in which it is located and from its privileged position within the logistic chain, thus assuring development that anticipates the needs of future generations, for their own benefit and the prosperity of the region that it serves (PIANC, 2014b). (Schipper et al., 2015)

- 'NO-IMPACT' port development

A port that has no negative impact on the ecosystem and recognizes ecological systems as a mix of elements that interact with each other in oceans and coast areas. (Schipper et al., 2015)

- EBDA

"A sustainable port achieves a balance on economic, environmental and social aspects, including the ecosystem within which it is situated regarding the port development process over the long term; working with society and nature to reach benefit and prosperity for the local region and country." (Vrolijk, 2015)

- ISPD

"A sustainable port is a port which has achieved and is maintaining a balance in economic, environmental and social extent for the surrounding local region. A sustainable port uses the Earth's resources for its own benefit without affecting its capacities for future generations." (Zheng, 2015)

3. Alternative frameworks

Integrated Sustainable Port Design Framework

The Integrated Sustainable Port Design Framework (ISPD) is inspired by the aforementioned design philosophy, is recently developed (2015) and has a general set up. Thereby it is applicable to many situations and as such it is interesting for the further research in this paper.

The ISPD framework defines the following steps:

- Define project needs and objectives
- Find suitable physical locations
- Understand the system and select most suitable location
- Develop alternative designs based on must-haves
- Test the alternatives
- Evaluate the qualities of each alternative
- Create the final design

According to the ISDP framework the location analysis is an important start to apply the framework. In the case of a transition port, the location is clearly fixed and therefore it is impossible to implement this step. However, the additional remarks give a useful insight in the recommended additions in comparison to the traditional port planning process. These differences with traditional port planning include the following:

- Analysis of physical, environmental, governmental and socio-economic disciplines of different potential suitable locations.

Despite the inability to choose a certain location for the port, it may be possible to locate certain functions within the port. This is among others depending on the size of the bay and the size of the proposed port. Hence the accompanied analyses prior to the location selection still can be executed in order to obtain a better understanding of the system.

- Early stakeholder involvement during the location choice.

Again, despite the inability to vary in the location selection, an early stakeholder involvement can be important in order to investigate

the locations of the specific functions that are proposed.

- Focus and systematically outline the values, opportunities of each potential suitable location.

Especially if the proposed port has a mixed function, this step can be valuable to the port transition. Instead of changing the physical location of the port, one could come up with several layouts for the port itself. The remaining steps could be executed similar to the steps as proposed by the ISPD framework.

- Prioritizing the values into key values after the preferred location is chosen.

After the choice of the preferred layout, the values are prioritized and transformed into must-haves.

Ecosystem Based Design Approach

The ecosystem based design approach entails “the search for an implementation strategy for sustainable port development: An ‘ecosystem-based port design approach’ (EBDA) is devised. This approach is applied working top-down, with a division on three levels; system, construction and material level. The focus of this research is set on the implementation of sustainability in the design-phase of a port development, targeting sustainable measures at the system level. The ecosystem-based design approach (EBDA) is based on existing philosophies (e.g. Building with Nature) and adopts theories from a PIANC-report on Sustainable Ports [Vellinga et al., 2014].” (Vrolijk, 2015)

- The approach consists of the following five steps.
- Understanding the system
- Designing alternatives
- Modelling alternatives
- Evaluating alternatives
- Final design

One can see that this system has many similarities with the ISPD after the choice for location. This is possible since both methods are largely based on the same design philosophy (i.e. building with nature).

Adaptive Port Planning (APP)

As an attempt to incorporate flexibility into the port planning procedure, the Adaptive Port Planning framework has been developed. This framework differs from the latter frameworks since it does not function as a flowchart. “APP recognizes uncertainties, accounts for flexibilities associated with a project, and can evaluate its investment potential with greater accuracy. This, in turn, helps to better evaluate the desirability of a long-term investment and leads to improved decision making.” (Taneja, 2013) Especially in sight of the speculations about the future situation in Cuba this uncertainty-based approach comes in handy for ports in transition.

“The implementation of APP has to be carried out in a multi-actor and multi-disciplinary setting crossing social, economic, environmental, legal, and political boundaries. The APP method is based on three fundamentals:

- Embracing uncertainty
- Acknowledging the role of flexibility
- Actively pursuing innovation” (Taneja, 2013)

The system is based on the ability to effectively implement flexibility in the design. Therefore one needs things that enable such a step; aspects that are necessary to implement such a method, but cannot be implemented directly. Therefore these enablers need an extra push, delivered by the drivers of flexibility. Aspects that slow down the implementation of such a system are called the barriers of flexibility.

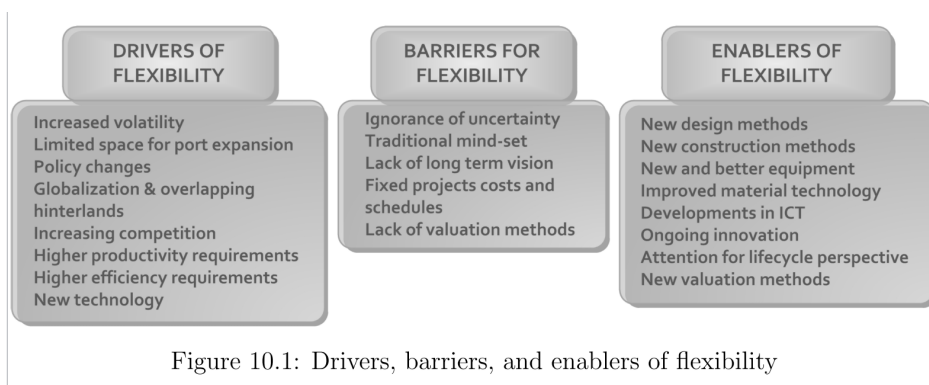


Figure 10.1: Drivers, barriers, and enablers of flexibility

Port of the Future

“No-impact port development and stimulation of welfare and

the protection of ecosystem services can be realised through active cooperation between PPP to require a financially positive business case. Furthermore, the location of port development often depends on governance factors as well. Port locations can differ in their morphology based on the natural system. Thus, the choice of a certain location stands in direct relation to certain necessary adjustments to the natural morphological system. For example, required depth and a proper connection with the hinterland are prerequisites in optimizing the ports' location and design to secure proper functioning of the harbour. In relation to the coastal ecosystem, the most optimal situation is the situation where there is as little as possible or no impact on the morphology, chemistry and biology. Thus, port development in locations where many adjustments to the coastal morphology are applied, are usually least favorable for ecosystem functioning. Ecosystem functioning directly relates to many ecosystem services the coastal ecosystem offers for human benefit. Therefore, in order to strive for an ecosystem based management approach in port development, location is a crucial aspect." (Schipper et al., 2015)

The Port of the Future study distinguishes traditional from sustainable port development by the (amount of) disciplines included in the port development process. By doing so, instead of only taking into account disciplines such as governance and economy, this model also includes disciplines such as ecosystem services, morphology and location. In Port of the Future the so-called No-Impact Port is the ideal outcome.

This study shows many similarities with the EBDA report, stating once again the importance of the location in the decision making process of the port. "Evaluation of port development by different disciplines has found that the location of the port is a crucial factor that links the different disciplines." (Schipper et al., 2015) However, what this quote clearly points out is that the location analysis is especially important because the design process is function driven. In other words it is based on the fear that some of the proposed functions of the port might not be able to operate in a sustainable manner at a certain location. For ports in transition this might be a different case, since the location is already fixed. In the available location a set of functions have to be found that can serve the several disciplines. For instance, if the bay were located in a vulnerable natural area or close to a historic city center, it would be easy to comprehend that this location would be less suited for the heavy industry.

“Each of these aforementioned disciplines has a requirement for the location of the port:

- **Ecological criteria**

The location should not contain any ecosystem functions that may be disturbed or destroyed and the current morphology needs to facilitate few adjustments to the system

- **Morphological criteria**

Coastal (hydro)-morphology of a location needs to facilitate a port

- **Governmental criteria**

The government of a location needs to be willing and relevant legislation needs to be in place

- **Socio-economic criteria**

A port needs to be required at a location and there needs to be a market”

Furthermore POTF stresses the importance of the People Planet Prosperity model and the stimulation of welfare. “No-impact port development and stimulation of welfare and the protection of ecosystem services can be realised through active cooperation between PPP to require a financially positive business case.” (Schipper et al., 2015)

Appendix D - Previously Developed Land (PDL)

112

1. Introduction

Since the awareness of the need of a more sustainable port development has taken place a lot of research has been conducted. The majority of this research however focuses on new or expanding port projects. The idea is that the port development of the future should aim to skip the mistakes that port development encountered in the past. Simultaneously however, many existing ports (e.g. Havana, Cuba) are still suffering from the conventional design methods and its subsequent downsides. Therefore, besides the need for a thorough understanding of sustainable port development, it is also necessary to conduct research on so called Previously Developed Land (PDL), also known as 'brownfield' sites. In this chapter an attempt is made to comprehend the current knowledge on PDL sites in order to apply it to the port transition framework. "While the planning literature has tended to focus on large waterfront regeneration projects, there has been less understanding of the characteristics and associated challenges facing regeneration of brownfield sites on the coast more generally (Rickey & Houghton, 2009)." (Leger et al., 2016)

2. Definition

The definition of PDL refers to 'any land or premises which has previously been used or developed and is not currently fully in use ... It may also be vacant, derelict, or contaminated' (Alker et al., 2000, p. 49). [...] In planning terms, such land does not have to be derelict land and can be in partial active use, although it must be zoned for comprehensive redevelopment under a renewal scheme or masterplan. Although the term 'brownfield' is often used interchangeably with PDL, it strictly includes other forms of under-utilized land, which has not been previously developed, such as quarries. (Sinnott et al., 2014, p. 9) (Leger et al., 2016) Sometimes the term 'greenfield' development is used to indicate a port expansion or the construction of a new port.

3. History

"With around half the world's population living within 60 km

of the sea, and three-quarters of all large cities located on the coast (UNEP, 2005), understanding the challenges of coastal urbanization and regeneration has become an important element of urban planning, not just in rapidly urbanizing parts of the world, but also in the developed world, where older coastal settlements are having to adapt to changing circumstances (Adams et al., 2010)." (Leger et al., 2016)

Although in the case of Havana the changing environment was mainly created by the crisis instead of the increased globalization and changing technology as it was the case in most European and North American port cities, the result of a left over port infrastructure in the midst of a valuable location is a similar scenario.

"Coastal settlements, whether rooted in port, defence or tourism economies, have experienced considerable economic, social and environmental change over the last 30–40 years, which has often resulted in building obsolescence and vacant land. Brownfield sites, especially on the waterfront, are strategically valuable, but can be constrained by costs of treatment, the fragmentation of available plots, complex landownership and declining property values." Brownfield areas are usually located in coastal urban areas, including port facilities, manufacturing sites, redundant dockyards, military installations and derelict tourist accommodations and attractions. (Leger et al., 2016)

These brownfield sites are often located at a valuable location on the waterfront. Especially with growing population in cities this location can be scarce and therefore attractive for project development. Despite the attractiveness of most of the Brownfield sites, project developers prefer greenfield projects over brownfield sites. "In most cases, brownfield land represents an important resource in the post-industrial transformation of coastal economies, as waterfront locations are valued for commercial, residential and leisure activities as well as place branding opportunities. The ability to realise these values, however, can be constrained by the development viability of sites released from former uses, determined by their scale, the extent of associated contamination, complex landownership patterns and the buoyancy of local economies, especially on former port and defence-related land. As a consequence, the regeneration of coastal brownfield land can require some form of public intervention." (Leger et al., 2016)

"In coastal urban areas, brownfield sites may possess advantages and opportunities for regeneration that may not be present in

other inland urban areas.” (Leger et al., 2016) “Regeneration also provides an opportunity to form a new relationship between the coast and the city as the waterfront is often the showpiece used to attract investors back into a city (Marshall, 2001). Land and property with coastal and sea views typically command a ‘premium’ price, which might encourage investors and developers to overcome some of the potential barriers inherent with such sites.” (Leger et al., 2016)

“Despite the prevalence of brownfield land and an acknowledgement by governments that brownfield development can tackle social, economic and environmental issues, which has been reflected in targets for the use of such land (Raco & Henderson, 2006; Baing, 2010), many barriers confront the redevelopment of these sites. Barriers include fear of unknown environmental conditions and contamination, regulatory controls, landownership constraints, potential delays prior to and during development, increased development costs associated with brownfields and negative image of brownfield sites (Adams & Hutchinson, 2000; Syms, 2004; Dixon, 2006), which can create low and uncertain rental or sales revenues (De Sousa, 2000). The barriers associated with brownfields can make them unviable and thus unattractive to potential developers in comparison with Greenfield land (Thornton et al., 2007; Wedding & Crawford-Brown, 2007). (Leger et al., 2016)

4. Challenges

“The existence of a coastline shapes their morphology so that typically they only possess 180° hinterlands (rather than 360°), which has implications for development in terms of market catchments and viability (DCLG, 2007). Coastal areas can also have difficult topographies, such as low-lying estuaries, river valleys and steep cliff lines, which may also support sensitive and protected environmental habitats and resources. The risk associated with coastal development is enhanced by the action of more extreme weather conditions, including storms, erosion, flooding and the need for increased property maintenance. These risks are likely to be accentuated by climate change over the coming decades, with sea level rises of 1–2 m and a greater frequency of storm events predicted (Zsomboky et al., 2011).” (Leger et al., 2016)

As a result of the rapid economic growth and globalization of the past decades, many port cities now face the challenge to deal with

the sites that have been previously developed. In contrary to the majority of the sustainability methodologies, 'brownfield' sites or PDL focuses on the sites that were developed in the past, but do not meet the demands of our current standards anymore. A large part of ports worldwide is still dealing with the legacy of previously developed land. This land was developed at times where there was little knowledge on the sustainability topic. Therefore these sites can for instance be inefficient, polluting, inflexible or expensive to maintain. Gaining knowledge about these sites has often been left outside of the scope of research. In order to alter this PDL research tries to find solutions to these mistakes of the past.

The definition of PDL refers to 'any land or premises which has previously been used or developed and is not currently fully in use ... It may also be vacant, derelict, or contaminated' (Alker et al., 2000, p. 49). [...] In planning terms, such land does not have to be derelict land and can be in partial active use, although it must be zoned for comprehensive redevelopment under a renewal scheme or masterplan. Although the term 'brownfield' is often used interchangeably with PDL, it strictly includes other forms of under-utilized land that has not been previously developed, such as quarries. (Sinnott et al., 2014, p. 9) (Leger et al., 2016). Sometimes the term 'greenfield' development is used to indicate a port expansion or the construction of a new port.

Whether these sites are attractive for developers is dependent on several aspects, summarized below. (Leger et al., 2016)

- Characteristics
 - Location
 - Scale of the site
 - Contamination
 - Landownership patterns
 - Local economy
 - Former defense-related land
 - Need of public intervention (sometimes)

Often developers still prefer Greenfield sites (land that has not been developed yet) over brownfields. The main barriers for this are the following. (Leger et al., 2016)

- Barriers to brownfield development
 - Fear of unknown environmental conditions
 - Fear of unknown contamination
 - Regulatory controls
 - Landownership constraints
 - Potential delays prior to and during developments
 - Increased development costs
 - Negative image of brownfield sites low or uncertain rental or sales revenues

Appendix E – Framework for a port in transition

1. Ideology of the framework

The frameworks that have been developed so far are derived from several sources, such as the United Nations Environment Programme (UNEP), PIANC, Port of the Future, Ecosystem Based Design Approach, Integrated Sustainable Port Design, The Flexible Port and Brownfield Development.

Since this is already a large source of information, the framework for a port in transition will be based upon the same information, but will be adjusted for ports in transition.

To a large extent, this framework has been based on the EBDA, which is derived from the UNEP report, the Ecosystem-based Management Markers for Assessing Progress and the PhD-thesis by Susan Taljaard (An implementation model for integrated coastal management in South Africa - from legislation to practice).

This ecosystem-based paradigm can be explained as follows. “The ecosystem-based paradigm is particularly aligned with the primary goal of integrated coastal zone management (ICM), namely “to achieve sustainable development of coastal and marine areas and reduce vulnerability, meanwhile improving the biodiversity, among coastal ecosystems”. To achieve this goal, it is necessary to protect the biodiversity and functioning of coastal ecosystem (i.e. the natural environment) so as to support important (beneficial) uses of the marine environment (i.e. social and economic values). Enhanced interaction between science and society is supported by moving from a centralised, top-down approach to governance to a decentralised regional and local approach to resource management in which multiple stakeholder groups are involved. Also, the incorporation of soft factors such as the values, attitudes, interests, and aspirations of stakeholders into the process is supported in this paradigm. If not, escalation of conflicts may ensue.” (Vrolijk, 2015) Within this ecosystem-based management, the following aspects have to be met.

- “The goods and services of the ecosystem (i.e. natural environment, social and economic dimensions) are placed centrally in the management process (versus sectors being central to the management process).

- The concept of spatial scale is incorporated, with interdependent plants, animals and human communities that interact within distinct spatial units (ecosystems).
- Participatory stakeholder involvement (i.e. resource management with multiple stakeholder groups).
- Cooperative governance between different stakeholders is required in the management of the ecosystem. This management model has been adapted to be useful for port planners and serves as an important base of this framework". (Vrolijk, 2016)

Appendix F – Driving forces

1. Introduction

In order to maintain a long-term view, this study uses assumptions how ‘the system’ (i.e. the bay of Havana) will be change in the future. In total four driving forces have been indicated of which two will be used for this study: climate change and political situation. Therefore these two developments will be further discussed in this chapter.

2. Climate change

Climate change is one of the driving forces for change in the bay of Havana. Therefore it is important to include the most accurate and recent information available. For this reason this study uses the projections of the IPCC assessment reports as our indicators. In the reference design the 4th IPCC assessment report from 2007 has been used. For this study we will use the 5th report from 2014.

In the latest IPCC assessment report REFERENCE IPCC the projected changes for the global climate system are the following: “Surface temperature is projected to rise over the 21st century under all assessed emission scenarios. It is very likely that heat waves will occur more often and last longer, and that extreme precipitation events will become more intense and frequent in many regions. The ocean will continue to warm and acidify, and global mean sea level to rise.” The predicted climate change takes place in various fields: air temperature, water cycle, sea level and extreme weather scenarios. These will be discussed in the following paragraphs.

Air temperature

“The global mean surface temperature change for the period 2016–2035 relative to 1986–2005 is similar for the four RCPs, and will likely be in the range 0.3°C to 0.7°C (medium confidence).

By the mid-21st century, the magnitude of the projected climate change is substantially affected by the choice of emissions scenarios.

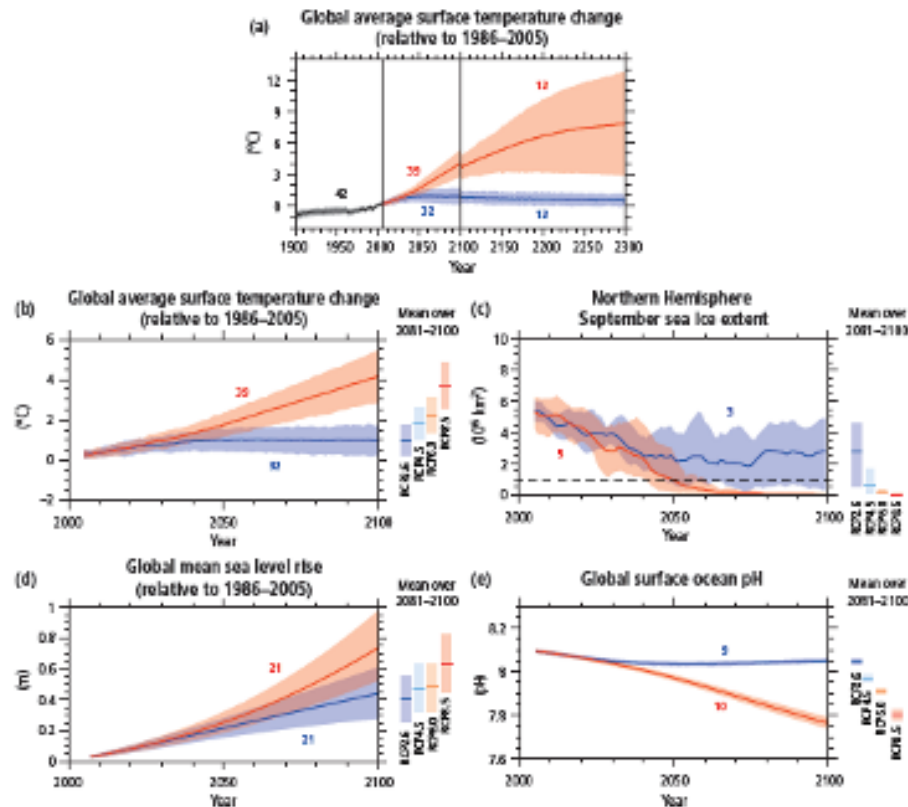


Figure 2.8 | (a) Time series of global annual change in mean surface temperature for the 1886–2000 period (relative to 1886–2005) from Coupled Model Intercomparison Project Phase 5 (CMIP5) concentration-driven experiments. Projections are shown for the multi-model mean (solid line) and the 5 to 95% range across the distribution of individual models (shading). Grey lines and shading represent the CMIP5 historical simulations. Discontinuities at 2100 are due to different numbers of models performing the simulation runs beyond the 21st century and have no physical meaning. (b) Same as (a) but for the 2081–2100 period (relative to 1886–2005). (c) Change in Northern Hemisphere September sea-ice extent (5 year running mean). The dashed line represents nearly ice-free conditions (i.e., when September sea ice extent is less than 10^6 km^2 for at least five consecutive years). (d) Change in global mean sea level. (e) Change in ocean surface pH. For all panels, time series of projections and a measure of uncertainty (shading) are shown for scenarios RCP2.6 (blue) and RCP8.5 (red). The number of CMIP5 models used to calculate the multi-model mean is indicated. The mean and associated uncertainties averaged over the 2081–2100 period are given for all RCP scenarios as coloured vertical bars on the right hand side of panels (b) to (e). For sea-ice extent (c), the projected mean and uncertainty (minimum–maximum range) is only given for the subset of models that most closely reproduce the climatological mean state and the 1979–2012 trend in the Arctic sea ice. For sea level (d), based on current understanding (from observations, physical understanding and modelling), only the collapse of marine-based sectors of the Antarctic ice sheet, if initiated, could cause global mean sea level to rise substantially above the likely range during the 21st century. However, there is *medium confidence* that this additional contribution would not exceed several tenths of a meter of sea level rise during the 21st century. (WGII Figure SPM.7, Figure SPM.9, Figure 12.5, 6.4.4, 12.4.1, 12.4.4, 13.5.1)

“Relative to 1850–1900, global surface temperature change for the end of the 21st century (2081–2100) is projected to likely exceed 1.5°C for RCP4.5, RCP6.0 and RCP8.5 (high confidence). Warming is likely to exceed 2°C for RCP6.0 and RCP8.5 (high confidence), more likely than not to exceed 2°C for RCP4.5 (medium confidence), but unlikely to exceed 2°C for RCP2.6 (medium confidence).” (IPCC, 2014)

The climate system is projected to respond in the following manner: “The equilibrium climate sensitivity (ECS) is likely in the range 1.5°C to 4.5°C , extremely unlikely less than 1°C , and very unlikely greater than 6°C .” (IPCC, 2014)

Water cycle

“Changes in precipitation in a warming world will not be uniform.

[...] Extreme precipitation events over most mid-latitude land masses and over wet tropical regions will very likely become more intense and more frequent as global mean surface temperature increases.” (IPCC, 2014)

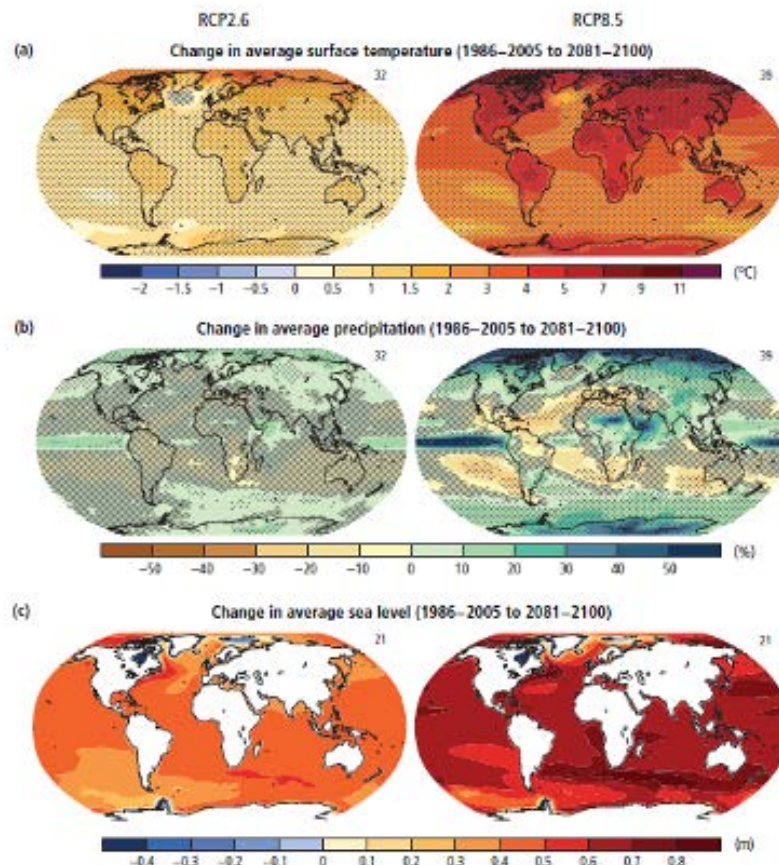


Figure 2.2 | Coupled Model Intercomparison Project Phase 5 (CMIP5) multi-model mean projections (i.e., the average of the model projections available) for the 2081–2100 period under the RCP2.6 (left) and RCP8.5 (right) scenarios for (a) change in annual mean surface temperature and (b) change in annual mean precipitation, in percentages, and (c) change in average sea level. Changes are shown relative to the 1986–2005 period. The number of CMIP5 models used to calculate the multi-model mean is indicated in the upper right corner of each panel. Dashed (dashed) on (a) and (b) indicates regions where the projected change is large compared to natural internal variability (i.e., greater than two standard deviations of internal variability in 30-year means) and where 90% of the models agree on the sign of change. Solid lines (diagonal lines) on (a) and (b) show regions where the projected change is less than one standard deviation of natural internal variability in 30-year means. (WGI Figure SPM.6, Figure 12.20, Box 12.1)

Ocean, cryosphere and sea level

“There has been significant improvement in understanding and projection of sea level change since the AR4. Global mean sea level rise will continue during the 21st century, very likely at a faster rate than observed from 1971 to 2010. For the period 2081–2100 relative to 1986–2005, the rise will likely be in the ranges of 0.26 to 0.55 m for RCP2.6, and of 0.45 to 0.82 m for RCP8.5 (medium confidence)¹⁰ (Figure SPM.6b). Sea level rise will not be uniform across regions. By the end of the 21st century, it is very likely that sea level will rise in more than about 95% of the ocean

area. About 70% of the coastlines worldwide are projected to experience a sea level change within $\pm 20\%$ of the global mean.” (IPCC, 2014)

“By 2100 for RCP8.5, the combination of high temperature and humidity in some areas for parts of the year is expected to compromise common human activities, including growing food and working outdoors (high confidence)” (IPCC, 2014)

“In urban areas climate change is projected to increase risks for people, assets, economies and ecosystems, including risks from heat stress, storms and extreme precipitation, inland and coastal flooding, landslides, air pollution, drought, water scarcity, sea level rise and storm surges (very high confidence).” (IPCC, 2014)

“It is likely that extreme sea levels (for example, as experienced in storm surges) have increased since 1970, being mainly the result of mean sea level rise.” (IPCC, 2014)

[Table SPM.2, 12.4.1, 13.5.1, Table 12.2, Table 13.5]

| | | 2046–2065 | | 2081–2100 | |
|--|----------|-----------|---------------------------|-----------|---------------------------|
| | Scenario | Mean | Likely range ^c | Mean | Likely range ^c |
| Global Mean Surface Temperature Change (°C) ^a | RCP2.6 | 1.0 | 0.4 to 1.6 | 1.0 | 0.3 to 1.7 |
| | RCP4.5 | 1.4 | 0.9 to 2.0 | 1.8 | 1.1 to 2.6 |
| | RCP6.0 | 1.3 | 0.8 to 1.8 | 2.2 | 1.4 to 3.1 |
| | RCP8.5 | 2.0 | 1.4 to 2.6 | 3.7 | 2.6 to 4.8 |
| | Scenario | Mean | Likely range ^d | Mean | Likely range ^d |
| Global Mean Sea Level Rise (m) ^b | RCP2.6 | 0.24 | 0.17 to 0.32 | 0.40 | 0.26 to 0.55 |
| | RCP4.5 | 0.26 | 0.19 to 0.33 | 0.47 | 0.32 to 0.63 |
| | RCP6.0 | 0.25 | 0.18 to 0.32 | 0.48 | 0.33 to 0.63 |
| | RCP8.5 | 0.30 | 0.22 to 0.38 | 0.63 | 0.45 to 0.82 |

^a

based on the Coupled Model Intercomparison Project Phase 5 (CMIP5) ensemble; changes calculated with respect to the 1986–2005 period. Using Hadley Centre Climatic Research Unit Gridded Surface Temperature Data Set 4 (HadCRUT4) and its uncertainty estimate (5 to 95% confidence interval), the observed warming from 1850–1900 to reference period 1986–2005 is 0.61 [0.55 to 0.67] °C. Likely ranges have not been assessed here with respect to earlier reference periods because methods are not generally available in the literature for combining the uncertainties in models and observations. Adding projected and observed changes does not account for potential effects of model biases compared to observations, and for natural internal variability during the observational reference period. (WGI 2.4.3, 11.2.2, 12.4.1, Table 12.2, Table 12.3)

^b based on 21 CMIP5 models; changes calculated with respect to the 1986–2005 period. Based on current understanding (from observations, physical understanding and modelling), only the collapse of marine-based sectors of the Antarctic ice sheet, if initiated, could cause global mean sea level to rise substantially above the likely range by the 21st century. There is *medium confidence* that this additional contribution would not exceed several tenths of a meter of sea level rise during the 21st century.

^c calculated from projections as 5 to 95% model ranges. These ranges are then assessed to be *likely* ranges after accounting for additional uncertainties or different levels of confidence in models. For projections of global mean surface temperature change in 2046–2065, *confidence is medium*, because the relative importance of natural internal variability, and uncertainty in non-greenhouse gas forcing and response, are larger than for the 2081–2100 period. The *likely* ranges for 2046–2065 do not take into account possible influence of factors that lead to the assessed range for near term (2016–2035) change in global mean surface temperature that is lower than the 5 to 95% range, because the influence of these factors on longer term projections has not been quantified due to insufficient scientific understanding. (WGI 11.3.1)

^d calculated from projections as 5 to 95% model ranges. These ranges are then assessed to be *likely* ranges after accounting for additional uncertainties or different levels of confidence in models. For projections of global mean sea level rise *confidence is medium* for both time horizons.

Future risks

The future risks of climate change seem to point out exactly the weak spots for the bay of Havana. “Key risks that span sectors and regions include the following (high confidence) {WGII SPM B-1}:

1. Risk of severe ill-health and disrupted livelihoods resulting from storm surges, sea level rise and coastal flooding; inland

flooding in some urban regions; and periods of extreme heat.

2. Systemic risks due to extreme weather events leading to breakdown of infrastructure networks and critical services.
3. Risk of food and water insecurity and loss of rural livelihoods and income, particularly for poorer populations.
4. Risk of loss of ecosystems, biodiversity and ecosystem goods, functions and services.” (IPCC, 2014)
5. Loss in tourist numbers. (Honey, 2016)

However, the added value of adaptation to the changing environment is expected to reduce climate change related risks. This is supporting the notion that intervention in the bay area of Havana can have a positive impact on the robustness of the region for the future. “Adaptation can substantially reduce the risks of climate change impacts, but greater rates and magnitude of climate change increase the likelihood of exceeding adaptation limits (high confidence).

However, the coastal systems is a severe threat to the safety of the Havana region. “Coastal systems and low-lying areas will increasingly experience submergence, flooding and erosion throughout the 21st century and beyond, due to sea level rise (very high confidence).” (IPCC, 2014)

Conclusion

The influence of climate change seems to have a significant impact on the bay of Havana. For the purpose of this study two distinctive projections will be made; one will represent a relative small impact of climate change, whilst the other will represent a large impact of climate change. These scenarios will be determined along the data found in the IPCC report.

- Extreme situation 1: small impact
 - Air temperature: 1.5 degrees Celcius increase by 2100
 - Sea level: 0.26 m rise by 2100
 - Extreme weather events (storm surgers, tornados, etc.): higher intensity (12%) and possibly higher frequency
 - Subsequent human consequences: none
 - Subsequent economic problems: none
 - Subsequent environmental problems: none

- Extreme situation 2: Large impact
 - Air temperature: 4.5 degrees Celcius increase by 2100.
 - Sea level: 0.85 m rise by 2100.
 - Extreme weather events (storm surgers, tornados, etc.): higher intensity (12%) and possibly higher frequency.
 - Subsequent human consequences: social problems (disrupted livelihoods), health issues (more diseases, casualties and victims).
 - Subsequent economic problems: Costs of critical services like infrastructure and networks will increase.
 - Subsequent environmental problems: increased pollution of (natural) water, flora and fauna and loss of certain biodiversity and ecosystem goods.

3. Politics

In order to the political situation that Cuba is facing today, it is important to understand a part of the history of Cuba. A very short discussion on this (political) history will be presented in this chapter. It will be used to determine the extreme cases that Cuba's politics could develop into. These extremes will be part of the aforementioned scenarios about Cuba's future.

Ever since the 20th century, Cuba's history is strongly influenced by its politics and international powers.

In 1898 Spain lost Cuba as its last colony to the United States of America.. Cuba was already an interest for the U.S.A. as it tried to acquire the island several times. Cuba officially became independent from the U.S.A. in 1902 but the U.S.A, remained the right to take part in its finances and foreign relations. Ever since then the country was influenced on cultural and economic aspects from the U.S.A..

From 1950 onwards the revolutionary movement came took flight. In 1959 the Cuban Revolution had succeeded as president Batista (supported by the U.S.A.) fled the country and the new rebellion powers took control and governed the country. Despite several attempts to take back control, the U.S.A. did not manage to regain its influence. The reaction of the U.S.A. was a embargo to isolate Cuba politically and economically. The popularity of these revolutionaries was large among the population.

Cuba developed towards a communistic state supported by the USSR. The American grandeur of the 50's and 60's changed to Soviet mass production and industries. This was also reflected by a strong equality for the population in terms of wealth, education, health and food.

Because of the collapse of the Soviet Union in 1991, Cuba lost its most important ally and a strong recession followed. There were many shortages of food and fuel, but the government managed to stay in place during this so-called Special Period. Cuba found new allies in Venezuela, China and Bolivia to maintain its socialistic or communistic ideology.

In 2008, Fidel Castro resigned and his brother Raúl Castro took a more open approach. Ever since then, small steps were made to open Cuba politically and economically. A large step was made in 2014 when president Barack Obama (U.S.A.) openly discussed the possibilities of removing the embargo. (Trotta, 2016)

This shift in political approach was also accompanied by a more open approach to private owned businesses. Small and middle-sized companies are nowadays allowed to be privately owned. (BBC, 2016)

How this development will continue is uncertain. Therefore this thesis will make two extreme assumptions of Cuba's political future: a socialistic ideology versus a capitalistic ideology. By this we mean a traditional socialistic approach with a centralized government and little room for privatization versus a smaller liberal government that allows for more privatization in small, middle and large sized companies.

Extreme situation A: Socialistic ideology

- Socialistic ideology
- Large central government
- Privatization only allowed in some small- and middle-sized companies and industries (e.g. tourism)
- Decision-making parties are all government related (i.e. ministries, workgroups, etc.)
- Extreme situation B: Capitalist ideology
 - Capitalistic approach
 - Small government
 - Privatization allowed for all sized companies in nearly every sector.
 - Decision-making parties are among the government, private parties and population.

Appendix G – Stakeholder analysis

126

1. Introduction

Part of gaining insight in the current situation in (the bay of) Havana consists of analyzing all interests of affected parties in a so-called stakeholder analysis. Although this has been done in the reference project as well and that stakeholder analysis will serve as a foundation, some adaptations will be made for the purpose of this study. One of the differences is that in this study it will be part of the first step of the study, before the must-haves and should-haves have been determined. The preliminary study indicated that participation and early stakeholder involvement are important for a sustainable result. Therefore this analysis has to be understood properly.

2. Methodology

This stakeholder analysis simulates the stakeholders' analysis from the reference project with small adjustments. Since this study uses scenarios as a part of the design study, four additional analyses will be made. These stakeholder analyses will depict how the stakeholder analysis would change if the (conventional reference) project would be proposed. This way it provides insight in the different parties that oppose the project and have a high 'priority' (explanation follows). The stakeholder analysis consists of steps which will now be shortly introduced.

In the first step, all stakeholders will be mentioned. An attempt will be made to perform this as inclusive as possible while refraining from being too detailed. For this reason, some stakeholders will be brought together in one group (e.g. shipyards, fishermen). Although the outcome of the design is not sure, some possible stakeholders will also be included, such as cruise operators and visitors, even though implementation of such services in the final design is not certain. These will be indicated in *italic script*.

In the second step the interests of the stakeholders will be indicated. From this step we will be able to estimate which parties are generally in favor of the project, and which ones are not. For this project, as an attempt to achieve improved stakeholder involvement, it is of special interest to gain more insight in all (opposing and supporting) stakeholders and their subsequent reasons. This way, the stakeholder analysis clearly

belongs in the first step of the framework “understanding the system”. The final should-haves and must-haves will follow from the interests of the stakeholders.

As third and final step the combination of ‘power’ and ‘interest’ leads to a combination that provides quick and clear overview of the stakeholders and their standpoint. In the method ‘Integral design in Civil Engineering’ (de Ridder, et al., 2009) this is called ‘prioritizing’. A high priority indicates a combination of high influence and interest (either opposing or supporting). High priority stakeholders can play a key role in the final approval of a project and therefore need special attention.

Finally the result will be reviewed to indicate the effects that a different political situation would have on the outcome. This is important since this will reflux on the outcome of the different scenarios. See table G.1 for the full inventory of stakeholders.

Nuance

Before the overview is presented, it is necessary to elaborate on some of the aforementioned stakeholders.

National government

For the national government it will make a great difference how they are incorporating the changing political situation in the port transition. If the government maintains the centralized strategy that it has today, it will have all the power to influence the project. In that case their priorities are key. In the positive case this would lead to an inclusion of the environmental awareness and a long-term sustainable approach. In the negative case however, they would be tempted to prefer short-term economic gains over the alternatives. If the government decides to introduce more room for privatization, the influence will shift towards other governmental departments, and (private) companies. This development will inevitably also influence the subsequent (semi) governmental organizations and departments.

Table G.1 - Overview of stakeholders including interest and attitude.

| Stakeholder | Interest | Conflict/agreement to the project | Attitude | # Attitude | Influence | # Influence | Priority (1-10) |
|---|---|--|---|------------|--|-------------|-----------------|
| National government | Increasing economic benefits, altering image Havana, creating role-model project | Principal client, biggest concern could be (initial, maintenance) costs | Positive | 8 | High | 10 | 10 |
| Workgroup government | Designing transformation for the bay, commissioned by the government | Very important stakeholder | Positive | 10 | High | 9 | 9 |
| Oficina del Historiador de la Ciudad | Preserve historic parts of the city. Can execute projects for the workgroup. | Important stakeholder of the project, general agreement | Positive | 9 | High | 7 | 8 |
| Ministry of economics and planning | Get more revenue from tourist branch. Wants renovation of the Havana Bay | Supporting tourism, agreeing on the project | Positive | 9 | High | 8 | 8 |
| Instituto Planificación Física | Determines area and releases permits for building | General agreement: this plan fits the vision of the government | Positive | 9 | High | 7 | 7 |
| Grupo de Trabajo Estatal Bahía de La Habana | Improving quality of environment in Bay Area | Unknown, dependency on the outcome. | Positive/Negative | 1 till 10 | Medium, easily overruled by governing parties. | 6 | 7 |
| Environmental organisations | Preserving nature and environment | Conflicting due to port expansion | Positive/Negative | 1 till 10 | Medium | 7 | 8 |
| Shipping companies | Building/maintaining ships | Agreement, overall business opportunities | Positive | 10 | Low | 3 | 3 |
| Ferry companies | To have a profitable business | Agreement (due to new ferry possibilities) | Positive | 9 | Medium | 4 | 4 |
| Cruise operators | Business development | Agreement, but conditions and regulations are important | Negative/Medium/Positive, depending on conditions | 1 till 10 | Medium, dependant on policy of government | 5 | 5 |
| Users of the cruise terminal | Using the cruise terminal and facilities | Agreement, visiting Havana main purpose | Positive | 10 | Low | 1 | 1 |
| Users of the marina | Using the marina and marina facilities | Agreement | Positive | 10 | Medium | 2 | 2 |
| Users of the ferry terminal | Using the ferry terminal and facilities | Agreement | Positive | 9 | Low | 1 | 1 |
| (Local) inhabitants in the region | Improvements to the neighborhood and high quality environment | Nuisance during construction. Possible positive effect is improvement to the area, but nuisance during exploitation is possible. | Positive/negative | 1 till 10 | Medium/High | 4 till 7 | 4 till 7 |
| Companies in the to be demolished buildings | Staying in the building and continuing their business | Conflicting: these companies would have to move due to tourist port Havana | Negative | 1 | Low-medium | 3 | 4 |
| Commercial harbour companies | Growing business for import/export | Conflicting: bay area more focuses on tourism instead of cargo activities | Negative | 3 | Medium | 4 | 5 |
| Fishermen | Fishing, making money, leisure | Conflicting due to the increased shipping in the harbour | Negative/positive, depending on policy | 1 till 8 | Low | 1 | 2 |
| Construction companies | (partially) constructing or renovating the project. Profit | General agreement | Positive | 9 | Low | 3 | 3 |
| Port authorities | Assure safety in the port at all times | General agreement, if safety can be guaranteed | Positive | 8 | Medium | 6 | 5 |
| Infrastructure companies (water, cables) | Deliver services without any downtime | Conflict during construction | Negative | 2 | Medium | 5 | 6 |
| Water treatment companies. | Water sanitation of domestic and industrial water. Provide clean water discharges into treatment plants or the bay. | Conflicting, although dependant on the outcome. Water treatment plants are supposed to be built | Negative/Medium | 3 till 7 | Medium | 5 | 6 |
| Local business owners in tourism sector | Provide services for tourists, such as restaurants, apartments, bars, etc. | Agreement, benefiting from influx of foreign tourists | Positive | 9 | Low | 2 | 2 |
| Multinationals | Provide services for tourists, such as hotels, bars and restaurants | General agreement, depending on the regulations. | Positive | 8 | Medium/Low | 4 | 4 |
| Polluting parties | Mix of small/large companies in several industries | Conflicting, depending on the imposed environmental regulations | Negative | 2 | Medium/Low | 1 till 6 | 7 till 8 |

Environmental organizations and the GTE-BH

If environmental awareness and subsequent measurements are included in the project, environmental organizations will have a positive attitude towards the project. The project could benefit from the expertise that these groups have on improving the quality of the environment. If this is not included in the project, it is likely that the project will not improve the environmental quality in the bay area. In that case these parties will oppose the ideas. Depending on the governmental situation, these groups can or cannot make a stance against this development. In case of a centralized government, (semi) governmental organizations can be overruled easily. Only non-governmental organizations or researchers could try to alter the development, but this is unlikely to make an impact.

(Local) inhabitants in the region

Since the bay of Havana is so characteristic for the city many inhabitants feel (somehow) connected to the project. Although inhabitants living nearby will experience construction and exploitation more notably, many citizens of Havana will feel affected by a large-scale transformation. During the fieldwork in collaboration with CUJAE citizens mentioned to have several concerns regarding the development:

An increasing influx of tourists will stress the infrastructure. Taxis, shared taxis, buses or ferries might lack the capacity serve the large demand of tourists. A transportation system with sufficient capacity seems to be important for both parties. Furthermore this will cause tourists to spread more easily throughout other parts city, which leads to a more equal distribution of the benefits and downsides of increased tourism.

There is a chance that this increased tourism stresses a small popular part of the city (e.g. Havana Vieja) and therefore will transform in a neighborhood merely used by tourists (e.g. hotels, restaurants, shops, museums). Both for tourists and locals this is not a preferred situation since it would force locals to leave their neighborhood, possibly lead to segregation or create a 'non-authentic' tourist experience in such neighborhoods. Therefore, livability for citizens should be protected in such areas.

Inhabitants of other adjacent neighborhoods such as Regla, have a strong affection and connection with the bay area because many of them used to have jobs in the port or still do. Hence, with the moving port activities and the strong sense of connection among the citizens, the

transformation might serve as a solution. However, it should be prevented that transformation leads to conflicts about (economic, environmental, etc.) benefits.

In the case of cruise tourism, the nuisance for local inhabitants or businessmen during the exploitation could be significant. This depends on the amount of noise, waste, smell they are allowed to produce and the time that vessels are allowed to be docked at the quays during which they might be blocking views in the bay.

Multinationals

The influx of multinationals to the bay area partially depends on the regulations that these companies will have to comply with. In case project development is fully allowed, large scale (waterfront) projects could be interesting from a business point of view. For the long term strategy of the project however, this is a questionable benefit. The preferred outcome and strategy therefore should be studied beforehand.

Industry in port area

Industrial companies in the bay area rely heavily on the master plan carried out by the responsible organization (now: national government). For instance, refinery Níco López, located in Casablanca, is still operational, has a large environmental impact and does not fit in the goal to transform the port in a sustainable tourist port. Therefore it should be reviewed whether or not this company can stay (under certain conditions) at the current locations, or that it should move elsewhere, perhaps by financial support of the government.

Polluting parties

Since pollution is a serious problem in the bay area, studies have pointed out over a hundred (direct or indirect) polluting sources for this location. ((CUJAE), n.d.; Cubadebate, 2016; Maal-Bared, 2006) The group is very diverse in size, industry, influence and level of pollution, but they have in common that imposed environmental regulations would harm their operational capacity in the short term. If the project leads to strong regulation with subsequent economic losses for these parties, they will be likely opposing the long term strategy. These industries might even lobby at government institutions for their own interest. Hence it is important to include their concerns in the strategy.

Overview

From the overview it becomes clear which are the parties with high priority. In total five figures are presented. The first figure depicts the reference project. This indicates the current situation, more or less as presented in the reference project (Stam et al., 2013). The remaining four figures represent the stakeholder analysis in the several scenarios. The scenarios are:

- Large influence climate change, centralized governance
- Large influence climate change, more privatized governance
- Small influence climate change, centralized governance
- Small influence climate change, more privatized governance

Reference Scenario

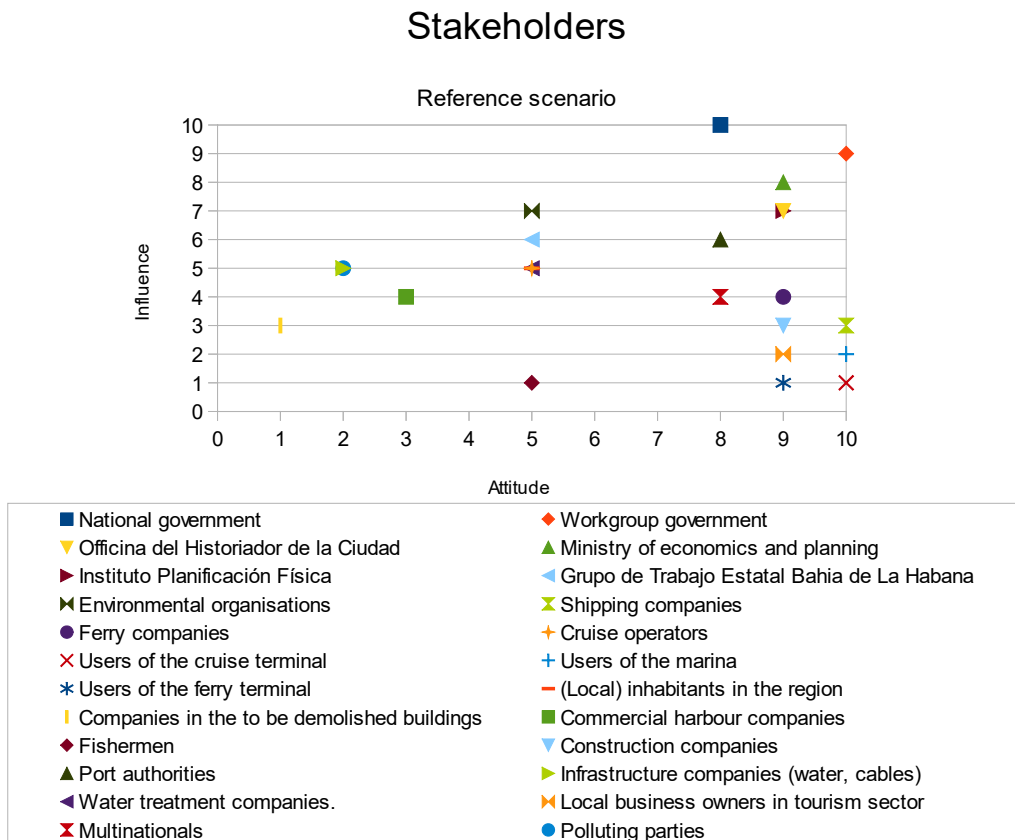


Figure G.1 Reference scenario

Scenario 1

The first scenario depicts the change if the government was to maintain its centralized strategy and there is a large influence of climate change.

The situation simulates a scenario where a conventional design including marina would be implemented. This would increase the approval rate for several parties to take action in some way, except for the environmentally concerned parties. After all, the conventional design would still not be implemented with a long-term or sustainable vision. Citizens would be likely to approve the developments, since the safety of the bay area and the city has to be guaranteed. Money to construct can be easily found in the tourist sector and among multinationals. The centralized government would have more support to 'overrule' other parties due to the urgency to act.

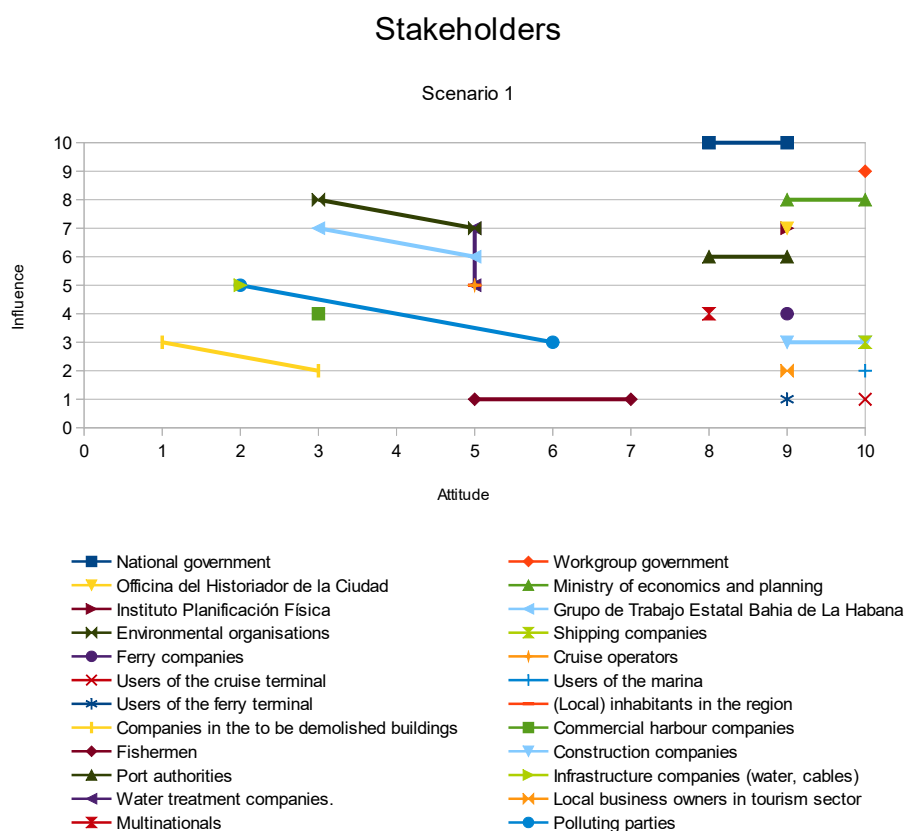


Figure G.2 Scenario 1

Scenario 2

The second scenario depicts the change if the government were to change its strategy towards a more privatized situation, but there would still be a large influence of climate change. The situation simulates a scenario where a conventional design would be implemented. This would increase the approval rate for several parties to take action, except for the environmentally concerned parties. Although these parties would have a larger influence, it would take more effort to convince decision-making parties to take more time trying to achieve a more sustainable result. The centralized government would have more support to 'override' other parties.

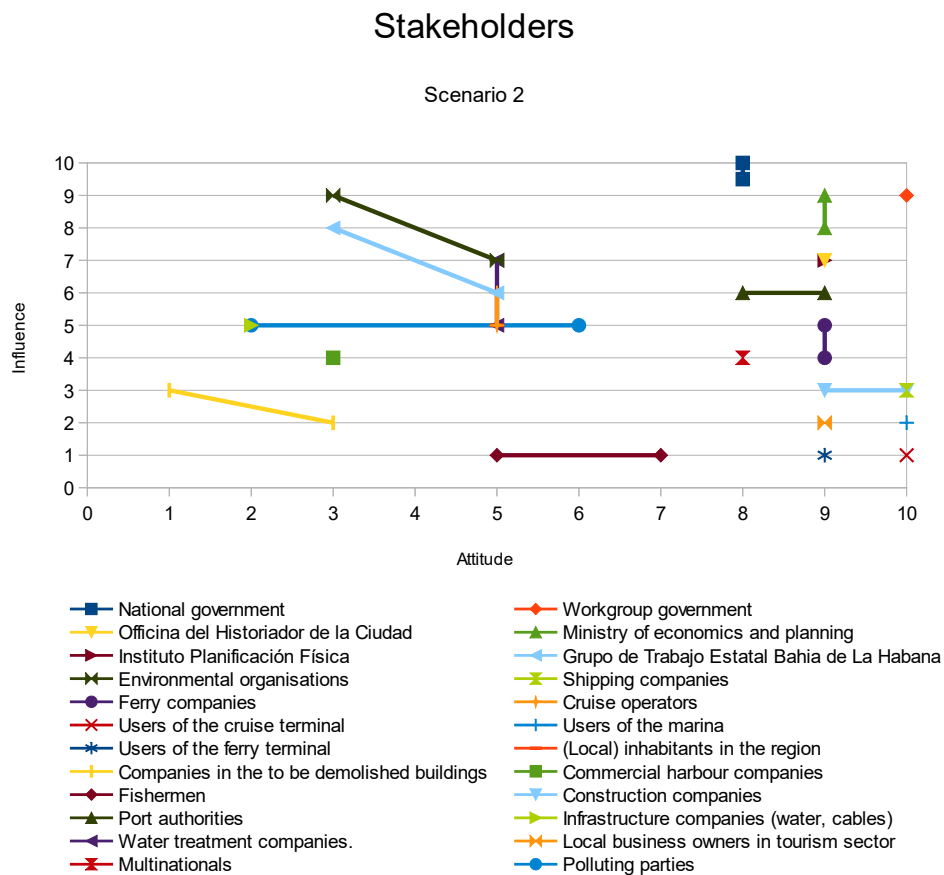


Figure G.3 Scenario 2

Scenario 3

The third scenario simulates a situation where the government is maintaining its centralized strategy, but there is little influence of climate change.

Since the urge to provide a solution did not increase, this scenario allows to take more time for a sustainable and long-term approach. Therefore opposing parties of the conventional design (such as environmentally concerned parties) can take more time to convince decision-making parties to alter the design approach. The same goes for citizens who would be more likely to support a sustainable design. The centralized government is still in control and can therefore make this happen. However, it goes without saying that this requires the government to fully support this approach and actively advocate and implement it. It would give more responsibility to the workgroup, since they are the ‘central’ organization who is eligible to take important decisions.

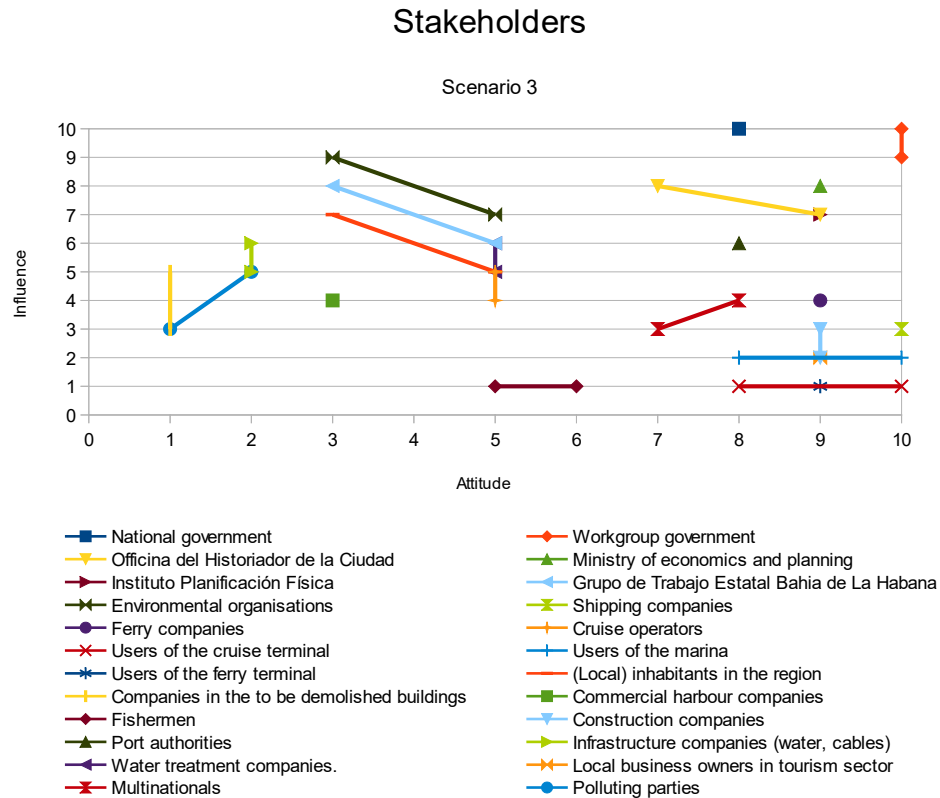


Figure G.4 Scenario 3

Scenario 4

The fourth scenario represents the situation where the influence of climate change would be small and the government would develop towards a more privatized society. Still, the urge to act would be relatively small and this would give more support for a long-term and sustainable approach. However, with the government handing its power to other parties, these parties will gain more influence. If the economic interests were high, it would be difficult to reach such an outcome, since a larger incentive from private parties (like industries, construction companies or cruise operators) could exist to take part in the design.

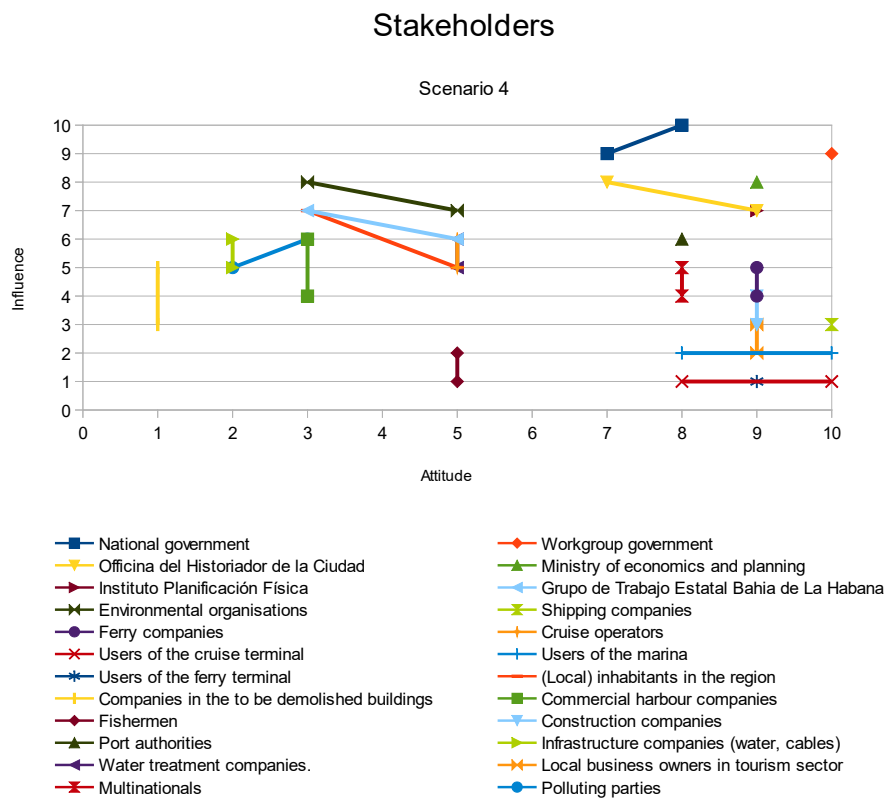


Figure G.5 Scenario 4

Conclusion

From the following five analyses it follows that the parties with a high priority are the following:

- National government
- Workgroup
- Ministry of Economics and Planning
- Port authority
- Environmental parties: GTE-BH & NGO's
- Citizens

From these parties the environmental parties and citizens tend to have an opposing view towards the reference project. Since this analysis is part of an early stage research how the stakeholders would see the project, there would be enough time to understand the concerns of these opposing parties. These parties do not have to be 'convinced' of the importance of the project, in stead, the decision making parties should try their best to understand these concerns and implement these in the design. Other opposing parties are:

- Polluting parties
- Water treatment companies
- Infrastructure companies
- Companies in the demolished buildings

The common thread among these parties is that these all face the results of in the bay of Havana. Although a long-term vision should incorporate a solution for these aspects, this might be beyond the scope of the project. However, it is recommended that an integral plan provides a solution.

From the aforementioned designs it can be concluded that climate change has a negative effect on the ability to implement a sustainable long-term vision project since more people could feel the urge to quick and effective solutions. Time to 'understand the system' and develop a thought-out project would be more difficult to justify.

A centralized government can have a positive influence on the outcome of the project, as long as the government truly prioritizes the must-haves and should-haves. On the other hand, citizen involvement could be smaller, since their opinion seems to matter less than in a more privatized system. Introduction

Appendix H - Tourism

1. Introduction

For Cuba, tourism is an important economic contributor as it is responsible for more than 10 % of the GDP. (Gonzalez, 2016) Therefore, it can be understood why healthy tourist conditions for this industry are preferable. Havana is planning to become a tourist port and without embargo, Havana can finally benefit from the increasing (global) tourism market. Despite the remains of the former industrial port, the lack of existing tourist facilities might also be beneficial since it leaves many options for development open. This chapter studies the effects of (cruise) tourism on the island and specifically the city and bay of Havana. Besides the general numbers and current developments in Cuban tourism, this paragraph will also address the possibilities to host sustainable tourism in Cuba.

2. Numbers

Cuba is an increasingly popular tourist destination. In 2015 a record number of more than three million tourists visited the largest Caribbean island and for 2016 3.7 millions are expected. (Gonzalez, 2016), With the downfall of the U.S. embargo more tourists are expected, especially from the United States. (Gross, 2016)

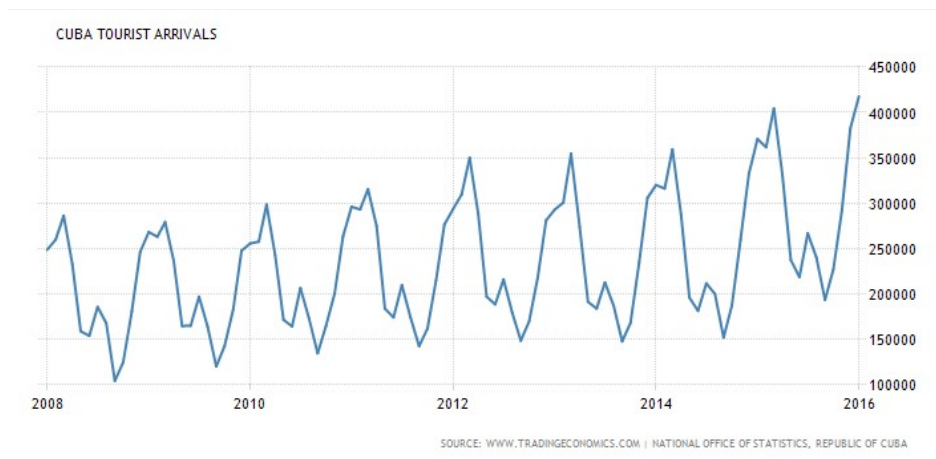


Figure H.1 tourist numbers in Cuba (Tradingeconomics, 2016)

Economically tourism is a very important contributor. "Tourism is a major economic driver and employment producer in Cuba where

it accounted for 10.4 percent of gdp and 9.6 percent of employment in 2014 with expected significant growth through 2024 including a 4.6 percent increase in total contribution to gdp (World Travel and Tourism Council 2015)” (Laitamaki et al., 2016)

Assets of Cuba for tourism

Before this chapter entails on further research on cruise tourism, it is worthwhile to discuss the assets that Cuba has to deploy sustainable tourism in general. These are (Honey, 2016):

- A healthy, well educated work force.
- Significant cultural and natural attractions: 10 World Heritage Sites, 275 National Monuments, 14 National Parks.
- Strong government role in tourism planning, policies, investment & operations.
- Dynamic small-scale private sector: paladares (local restaurants) and casas particulares (local bed & breakfasts).
- Havana: the most culturally/historically rich city in the Caribbean.
- Opportunities to create and capture the high value tourism market that is distinct from the Caribbean's typical mass market, sun & sand tourism.

3. Environmental governance

In this sub chapter we will discuss the environmental policies on two levels: nationwide and port authority.

Caribbean Sustainable Tourism Policy (CSTP)

Despite the economic benefit of tourism, it can also cause an impact on the environment. Under the National Program of Environment and Development Cuba implemented sustainable tourism initiatives of the UNWTO (United Nations World Tourism Organization) and the CSTP (Caribbean Sustainable Tourism Policy). Currently, Cuba is using the CSTP (Caribbean Sustainable Tourism Policy) Framework as its guideline. “The CSTP Framework is composed of one overarching vision, ten principles, six development goals and six corresponding integrated policy areas which are: (1) tourism management capacity, (2) marketing, (3) transportation, (4) environment, (5) linkages and (6) health, safety and

security issues.” (Laitamaki et al., 2016)

“The Cuban government has implemented several sustainable tourism initiatives since 1992 by incorporating areas of the United Nations World Tourism Organization (unwto) and the Caribbean Sustainable Tourism Policy (cstp) Frameworks into the Tourism Development Plan under the National Program of Environment and Development.” (Laitamaki et al., 2016) Moreover the purpose of these developments is to provide more than an alternative to conventional tourism. “According to Bramwell and Lane (1993), who are among the first re-searchers in this field, sustainable tourism has moved away from being an active response to (negative) tourism issues to becoming a solution creating positive change.” (Laitamaki et al., 2016)

Port management analysis

Port management is important to both the managing and executing the port strategy. This implies that achieving the preferred result is only feasible with a supporting port management structure.

Zolfani found that “fiscal policy plays a crucial role in the success or failure of a sustainable tourism plan, for example, the extent of state ownership, tax reform and subsidies. He also found that social inclusion is critical to a sustainable tourism product since it contributes to the overall health of society, reducing crime and social conflict. Ultimately, a flexible integrated plan that includes macro, sectoral and micro interests will allow for Caribbean nations to develop longterm economic strategies, not governed by short-term gains, that will also preserve resources, both natural and social.” (Laitamaki et al., 2016)

Like all large organizations, the socialistic state is currently in control of the port management. A special group directly appointed by the government is currently developing the plans for the transition of the bay, including its must-haves, should-haves and its stance on topics like sustainability. “Sustainable tourism development in Cuba is driven by strong political will that is enforced by the Cuban Constitution, Environmental Laws and the National Program of Environment and Development.” (Laitamaki et al., 2016)

4. Cruise tourism

Although several types of tourism could be hosted in the

bay of Havana, for the purpose of this study, we will focus on cruise tourism, since this is a type of tourism discussed in the reference project. Furthermore, it is a returning type of tourism for the country. The focus of this sub chapter will be the investigation of common and other possible downsides to cruise tourism, but also the advantages and best-case examples.

Although the cruise industry is a relatively small contributor in the number of tourists in Havana or Cuba, the impact for Havana and the environment is significant. (Klein, 2011b) From an environmental point of view there are some considerations regarding environmental impact by (cruise) tourism. “A fundamental difficulty with sustainability assessments is that of quantifying and costing environmental impacts in the same way that economic benefits can be presented.” (Johnson, 2002) Although this quantification can be difficult, the LCA methodology helps by categorizing environmental impact of the cruise tourism industry. Following the structure of the thesis of Johnson, these impacts can be found in the following ways.

- Infrastructure impacts
- Operational impacts
- Distribution impacts
- Use impacts
- Waste impacts

5. Actors

The following actors can influence these impacts:

Operators

- Varying itineraries to avoid exceeding carrying capacity
- Passenger numbers
- Destination rehabilitation/conservation projects
- Environmental management
- Technological improvements to reduce operational impacts
- Rewards for environmental awareness
- Educational initiatives

Destinations

- How can destinations manage the impacts of cruise tourism

- Which destinations are environmentally unsuitable
- Economic measures
- Can educational management tools help destination use impacts?

Tourists

- Have largely failed to exert the fundamental pressure necessary to ensure real environmental improvements.

These aspects will serve as the main advice to incorporate sustainable ways of hosting cruise tourism. Since tourists have failed to exert pressure to alter the way the cruise industry functions, it seems to be more effective to focus the tourism policy on the operators and destinations. By creating clear conditions for the operators and hosting cities, the situation could change. Among others because adding Cuba as a destination of cruise operators could be an advantage compared to other operators. If this is only possible for operators who ensure to limit their environmental impact, it could be a start to alter the common practices.

6. Infrastructure impacts

With an increase of tourists in the city of Havana and the bay area, the supporting infrastructure needs to be able to provide sufficient capacity. In this case, relative up-to-date data is available about the infrastructure in the bay area due to an equal study conducted by (Stam et al., 2013). Hence, this information will be the main source for this study. This study assumes the construction of a marina and ferry terminal. However, the study fails to address the additional means of transportation, i.e. public transportation by means of buses and (collective) cabs. This will play a role with cruise tourism due to its peak load of tourists entering by cruise ships hence without cars.

For both the marina and the international ferry terminal, a good accessibility is essential. The visiting tourists must be able to come and go from the marina without creating congestion in the transport network around the bay. On the other hand, the international ferry terminal generates high peaks of passenger flows when ferries arrive or depart. A smooth flow of passengers is a requirement for a properly operating ferry terminal. This chapter covers the results of the infrastructural analysis performed to anticipate problems with the connections of the marina and

the international ferry terminal. The scope of this analysis is focused on the arterial roads around the bay and their connections. (Stam et al., 2013).

Road layout

“The most important road for the connections of the marina and ferry terminal is the main road around the bay: the Avenida del Puerto. This road leads from la Punta, at the mouth of the entrance channel, all the way along the bay towards Regla. The most relevant connections of the Avenida del Puerto are the intersections with Avenida de Bélgica, Arroyo and Jesus Lopez since these connections distribute the traffic from Habana Vieja in north, west and south direction, respectively. An overview of these roads is given in figure H.2.” (Stam et al., 2013)

Traffic characteristics

The project area has a very diverse mix in traffic. Old and new cars, old buses and trucks, many pedestrians and tourist activities make this area very diverse in its functions. This is an important factor in designing the road infrastructure. Since the traffic from the Havana Vieja neighbourhood is only distributed by the Avenida del Puerto on one side and by Paseo de Marti on the other side, the Avenida del Puerto is an important distributor road. But with the increase of tourism around the bay, this conflicts with the access functions at the harbour and Havana Vieja. This location is the main touristic area of Havana, with many tourists walking on both sides of the Avenida del Puerto. The addition of a marina and a ferry terminal in the south-western part of the bay will enlarge this problem. (Stam et al., 2013)



figure H.2 – road network overview around the bay

6.1 Traffic counts

Traffic characteristics

The project area has a very diverse mix in traffic. Old and new cars, old buses and trucks, many pedestrians and tourist activities make this area very diverse in its functions. This is an important factor in designing the road infrastructure. Since the traffic from the Havana Vieja quarter is only distributed by the Avenida del Puerto on one side and by Paseo de Martí on the other side, the Avenida del Puerto is an important distributor road. But with the increase of tourism around the bay, this conflicts with the access functions at the harbour and Havana Vieja. This location is the main touristic area of Havana, with many tourists walking on both sides of the Avenida del Puerto . The addition of a marina and a ferry terminal in the south-western part of the bay will enlarge this problem. (Stam et al., 2013)

Traffic counts

In order to find the normative flows in the project area, data of counts on three intersections has been analysed. The data shows a peak hour flow of 3.158 Vehicle Equivalent (VE) at the intersection between Avenida del Puerto and Arroyo between 9 and 10 am. Most of this traffic originates from the Habana Vieja quarter (see figure H.3). This means that intensities on the road are currently very low. The intersection between the Avenida del Puerto and Jesus Lopez is even more remote with a peak hour flow of 2.475 VE. The intersection between the Avenida del Puerto and the Avenida del Bélgica is not analysed for counts, as data is lacking.

A clear morning peak is visible in the flow-time diagram, the evening peak is less apparent. This does not apply for all roads. On Fabrica, a road parallel to the Avenida del Puerto, a clear evening peak is visible in opposite direction. Furthermore, the data shows that trucks play an important role in traffic at the southern end of the bay. The commercial harbour activities generate a high share of cargo transportation here. In the northern part, towards Havana Vieja, the share of trucks decreases notably. (Stam et al., 2013)

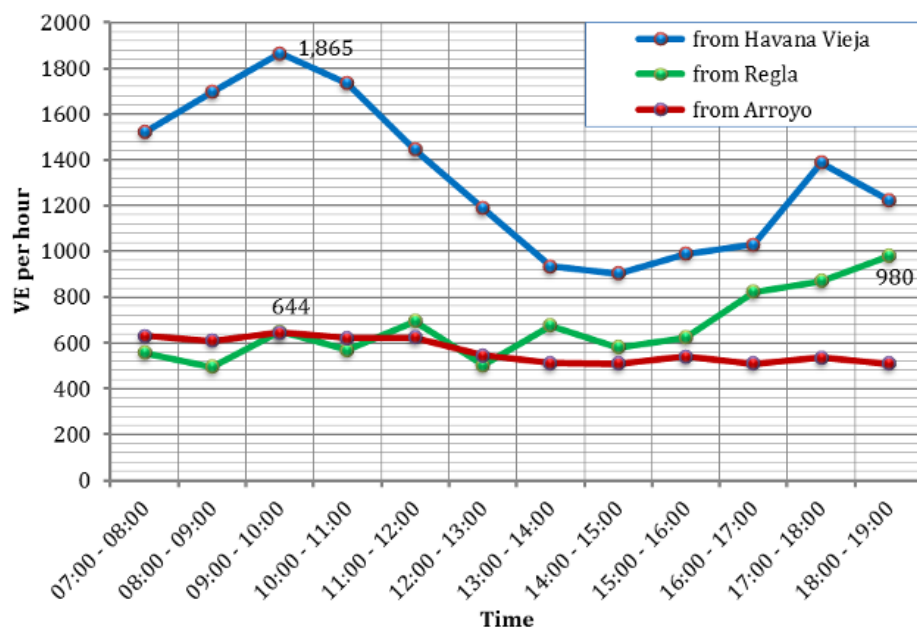


Figure H.3 – flows per origin at intersection Avenida del Puerto and Arroyo

Safety

This paragraph discusses the traffic safety concerns in the project area. The crash statistics of the period 2003-2008 are analysed to locate the locations with a high crash risk. Second, the principles of Sustainable Safety are applied to the current road layout to indicate possible safety improvements (This vision on traffic safety is developed by the Dutch SWOV Institute for Road Safety Research. (www.sustainablesafety.nl)) (Stam et al., 2013)

Crashes

The crash data consists off all recorded crashes in the larger area of Havana between 2003 and 2008. From this source, the data of the relevant roads for the project has been filtered. Because the data on the consequences of these crashes is inconsistent, only the number of crashes is analysed to identify high risk locations. The top 10 locations with most crashes are indicated in figure H.4 The area of research is indicated in grey. The intersection between Avenida del Puerto and Avenida de Bélgica tops the list with 36 crashes. This roundabout is therefore indicated as a high risk location. The nearby intersections of Jesus Lopez with Avenida del Puerto and Fabrica are on places 6 and 7, respectively. When taken together, they would have been in the first place. This is even without the crashes involving a train, as these are mentioned separately in place 5. This is done because of the sometimes unclear reference to the location.

It is clear that the safety of these locations is an issue when designing the marina and the international ferry terminal, as the entries are close to some high risk locations. Safe transportation from and to the port facilities has to be guaranteed. (Stam et al., 2013)

6.2 Improvements from sustainable safety

The following improvements of the traffic system could be identified:

- Clear speed signage;
- Decreased speed at intersections (with roundabouts or plateaus);
- Consistent lining indicating directions and transition of lanes;
- The shielding of obstacles along the road;
- Removal of parking in the centre of the road;



figure H.4 – high crash risk locations (number of crashes in five years)

- The addition of pedestrian crossings;
- The enlargement of sidewalks.

These possible safety improvements are taken into account in the design of the connections of the marina and international ferry terminal.

Traffic Development

The traffic growth in Cuba, specifically in Havana, is obviously a very important factor for a design of a new road layout around the marina and ferry terminal. Currently, the car use is increasing rapidly. The Department of Roads of CUJAE University (2013) estimates the current traffic growth at 8% per year. If this growth continues for a planning horizon of 50 years, this would mean an increase of traffic with a factor 47. This is very implausible as the traffic growth will almost certainly not continue at the current rate. For long term planning in Cuba, commonly a growth rate of 1.5% is used, but this does not match the current growth. Therefore a top-lognormal function has been applied on the growth rate, to fit both the current growth as well as the expected eventual growth in 2060. The flows are expected to approach the estimated peak of 2060 in the next 15 years, after which the growth will flatten out.

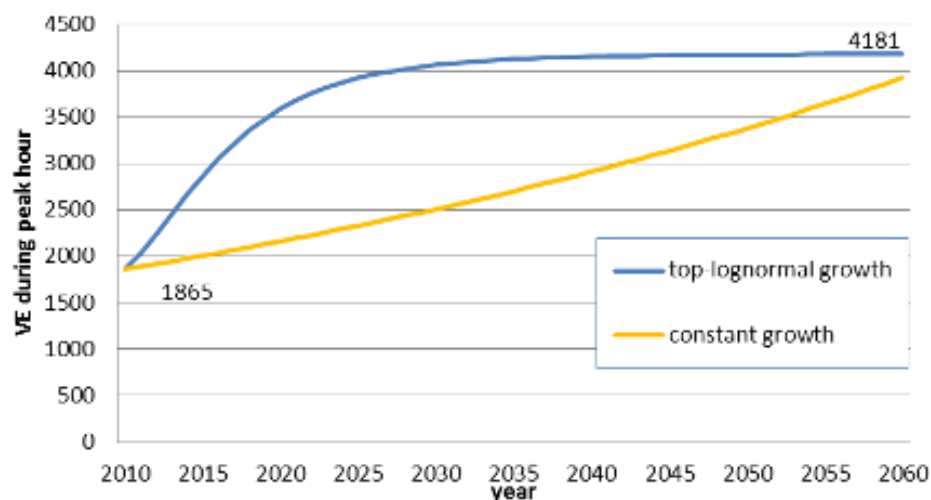


figure H.5 – growth of normative peak hour flow

Traffic generated by the marina

The traffic flow generated by the marina is very small. Even if all 270 yachts would have a car available and leave in the same hour, which is practically unthinkable, this would still be only a minor part of the total flow. However, the marina does create merging and crossing traffic in an area where space is very limited due to surrounding buildings. It also has to be well accessible for supply trucks and tankers for provision of the marina.

Traffic generated by the international ferry terminal

The international ferry terminal, in contradiction to the marina, does create peak flows of passengers. A departing ferry is estimated to attract 420 cars, but this flow is spread over approximately two hours as passengers have to go through the customs procedure. This generated extra traffic could still cause capacity problems on the Avenida del Puerto in peak hours. Short term parking facilities have to be present, as well as taxi stands, bus stands and so called kiss and wave stands. Long term parking should be provided within walking distance of the terminal building.

6.3 Bottlenecks

A total of twelve bottlenecks in the network around the project area has been identified. Only the most relevant bottlenecks are discussed here: the intersections of the Avenida del Puerto with Avenida de Bélgica and Arroyo.

Intersection between av. del puerto and av. de Belgica

The intersection between Avenida del Puerto and Avenida de Bélgica is near the entrance of the marina. This roundabout has the most crashes in the project area, therefore it can be concluded there is a road safety problem at this location. With the expected growth of traffic and the extra connection of the marina, this problem will further increase. Therefore, measures have to be taken to increase safety at this point. The remains of the old city wall in the centre and next to the roundabout are a limiting design factor in this location, together with the proximity of the terminal.



Figure H.6 – overview of intersections of Avenida del Puerto with Avenida de Bélgica (left) and Arroyo (right)

Intersection between av. del puerto and Arroyo.

The intersection between Avenida del Puerto and Arroyo is near the international ferry terminal. Here the connection is hindered by two railway tracks, one on ground level and one elevated. This connection is essential to the main network of the city of Havana. Currently, it is a very confusing intersection, which will become a problem with increasing flows and more tourists driving in the area.

7. Operational impacts

The operational impacts will be studied on nautical level, since vessels will mainly use the bay area. The landside activities are covered in the infrastructure part.

Nautical analysis

The reference study comprises an investigation on the nautical analysis in the bay. The assumption made is that the bay will transform into a tourist bay and will be used by cruise vessels and (a new) ferry. An overview is given of the design vessels, the existing nautical infrastructure, future growth and finally vessel interactions.

Design vessels

- Entrance channel

The depth of the channel, restricted by the tunnel beneath, limits the maximum draught of particularly cargo vessels like bulk

carriers. The design vessel regarding the entrance channel is therefore a cruise ship, which combines a relatively small draught with a wider beam.

The maximum dimensions of a cruise ship are limited by the length of the pier of the cruise terminal. The maximum length of a ship the terminal can accommodate is 245 m, so an example of a normative vessel is the “MS Zaandam” with dimensions of 237x32.3x8.1 m³. (Stam et al., 2013)

- **Ferry service**

The Damen Fast Ropax 6016 (see figure H.7) is, given its sailing speed, recommended for the connection with Key West and Miami. The Damen Fast Ropax 5114, with a lower capacity, can be used in the early operational stages of the ferry. (Stam et al., 2013)



figure H.7 – the Damen Fast Ropax 6016. dimensions: 60x16.2x2.0 m³ maximum speed: 35.0 kn capacity: 660 passengers and 49 cars

Mega yachts

Mega yachts will be normative for the dimensions of the marina. Examples of mega yachts are the ‘Amels 180’ with dimensions of 55x9.4x3.4 m³ or the ‘Limitless’ with dimensions of 97x12x3.7 m³.

The national market for yachts in Cuba is currently non-existing as the only inhabitants with a private boat are fishermen (Valle Benero, 2013). It is therefore expected that the marina in the Bay of Havana will hardly be used as a homeport. (Stam et al., 2013)

Capacity of the existing infrastructure

- Depth

The minimum cross section of the channel determines what sizes of vessels are able to enter the port basin. Particularly the depth of the channel is a restriction as it determines the maximum draught of a vessel that can enter the basin. The maximum draught of a vessel that the port can accommodate is 11.58 m

- Width capacity of the entrance channel

It can be concluded that cargo vessels and cruises cannot be accommodated in a two-way configuration in the entrance channel. Ferries and yachts can use the channel in a two-way configuration. Note that ferries and cruises will usually not arrive and/or depart at the same time since these lines make use of a strict time schedule. Besides, it is not expected that more than a single mega yacht will arrive at the same time. It is therefore assumed that in the current situation:

- Cargo vessels always sail in one-way traffic configuration.
- Cruises, ferries and mega yachts will sail in a one-way traffic configuration.
- Yachts of average dimensions can sail in two- or even more way configuration.

Berthing facilities

The Port of Havana currently has only one terminal that is able to receive tourist related vessels: the cruise terminal which has just one pier in use. The master plan of 'Tourist Port Havana' however requires different berths for several types of tourist vessels.

Anchorage

Three dedicated anchorages are present in the Bay of Havana. The locations of these anchorages are depicted in figure H.8.



figure H.8 – anchorages in the Bay of Havana. current situation

7.1 Intensity and future growth

Little is known about the current shipping intensities in the Bay of Havana. Only the container terminal has regular calls with three times a week. By account of the traffic control service, on average one liquid and one dry bulk vessel arrive per week. In general, two or three vessels arrive at the port on an average day. According to local experts this will change rapidly with the development of the port of Mariel and the transformation of the bay of Havana.

The expected economic growth in Cuba, especially after the possible lifting of the embargo, will lead to an increase in commercial activities in the country and the Bay of Havana. Moreover, as a result of Tourist Port Havana, an increase in traffic of tourist related vessels is to be expected. The overall harbour activities will as a result intensify, and thus more calls and traffic are expected.

In order to become successful, it is vital that the port can accommodate future tourist supply in a safe and comfortable way. Conflicts must therefore be prevented by providing sufficient capacity and/or a traffic control system. Hindrance of tourism and commercially

related vessels must be minimized as much as possible.

The intensity of traffic in the bay that can be expected partly depends on the development of other ports on the island. Cargo ships can be attracted by other ports in Cuba by for example better equipment, shorter sailing distances, shorter service times or to avoid waiting times. As a result, the number of calls in the Port of Havana could be negatively affected. Cuba has a total of seven major ports: Havana, Mariel, Santiago de Cuba, Cienfuegos, Matanzas, Antilla and Nuevitas (Achermann, 2007). Especially the developments in Mariel will influence the future of the Port of Havana.

Marinas in other parts of the country can conversely cause an increase of the number of calls of yachts in Havana. With multiple marinas in the country, Cuba would be a more attractive destination for yachts as it would make a trip around the island possible. Marinas in the close proximity of Havana will of course have a

negative effect on the number of calls in the future marina. (Stam et al., 2013)

8. Use impacts

The use of the bay of Havana will partially be determined by the use of the nautical traffic. This has been investigated in the reference study as well. The most important outcomes will be shortly discussed.

8.1 Nautical traffic

Limitations

“According to the current legislation, no manoeuvring is allowed in the entrance channel with wind speeds of 6 Bft and higher. However, even with these wind speeds, the entrance channel should have sufficient width for vessels entering or leaving the port in accordance with the guidelines. Nevertheless, the current legislation has been evolved by practical experience over years, and should therefore be respected (PIANC, 1995).

Although wind speeds of 6 Bft and higher only occur about 5% per year, it is preferred to decrease downtime as much as possible. A possible method to investigate this is by means of a manoeuvring simulation program.” (Stam et al., 2013)

Traffic scheduling

“Vessels calling the Port of Havana are divided in four categories: cruises, ferries, yachts and cargo ships. These four classes are each given a window during which they can enter or leave the port. The recommended order of priority is given below: (Stam et al., 2013)

1. Ferries

Ferries sail according a tight schedule that will be similar every day. Therefore the ferries are given the highest priority when encountering another vessel.

2. Cruise ships

On this topic the reference project and this study differ slightly. The reference project acknowledges the importance of the cruise ships for the Cuban economy and therefore wants to host them as often and comfortable as possible. This study however investigates the options to limit the amount of cruise ships hosted in order to create a better situation for the entire bay area. This could lead to a limited amount of cruise ships given access to the bay area. Cruise industry could indeed be important for the Cuban economy. As Havana will probably be a significant cruise destination, high wages can be asked of the cruise operators. The Port of Havana will have to give some reliability in return, as cruise companies will skip Havana just as easily if waiting times are excessively high. After all, cruise lines are thriving today without Havana as destination. However, if cruise ships only under certain conditions are allowed to enter the bay, this could increase the incentive to alter the sustainability of cruise operators. Furthermore the reference project states that if the Port of Havana wants to be a ‘tourist port’, the cruise activities should become the central activity. This study however studies a more integral approach to the transformation of the bay without giving the cruise activities too much influence.

3. Cargo vessels

Cargo vessels are likely to have a smaller share in the total fleet of vessels attending Havana in the upcoming years. If they do arrive, cargo transporting ships will not welcome waiting times, but they can notify the port authorities about their arrival days in advance. The authorities can anticipate on this call by adjusting the time schedule or, more plausibly, by notifying the captain of the cargo vessel about the exact time window at which entrance is allowed. The captain can then adjust the sailing velocity

in such a way that the estimated time of arrival fits in the window. Cargo vessels are used to this strategy, as many ports are operating with a tidal window. Moreover, this method reduces fuel costs. It is however still a hidden form of waiting time (Ligteringen, 2009).

4. Yachts

The number of yachts can become numerous. Moreover, yachts have unreliable arrival times and have above all a non-commercial nature. They are therefore given the least priority. It is recommended to assign a fixed window to the entrance of yachts which is commonly known among yachtsmen. When necessary, the duration of the window can be adjusted to the yachting season. Multiple yachts can then enter the bay during this window at which commercial shipping is temporary prohibited. Yachtsmen can adjust the estimated time of arrival to this window, or otherwise have to wait until the next window. When a yacht cannot make the window on time, it is also possible to sail to Marina Hemingway.

Using the above priorities an example traffic schedule has been drafted (see table H.1). During the touristic high season, four cruise ships have to enter in the morning and leave in the evening. This leads to long windows for cruise ships after which the windows for cargo vessels cannot be maintained. Although cargo ships have a higher priority than yachts, it has been decided to sustain the yachting window around 14:00 h. Consistency is important for the window for yachts, as yachtsmen are not easy to be informed about daily changing window times. It is therefore apparent that cargo shipping is only possible at night during touristic high season. Hence, if the Port of Havana decides to focus on tourism, the attractiveness of the port as a destination for cargo vessels decreases significantly. As a result, cargo activities of especially bulk carriers and container ships should probably be relocated to other ports in the country.

Table H.1

| Opening [h] | Closing [h] | Vessel | Remark |
|-------------|-------------|-------------|---|
| 06:00 | 07:30 | Ferry | Arrival from overnight trips, departure to Key West |
| 07:30 | 12:00 | Cruise ship | Arrival of cruise ships |
| 12:00 | 15:00 | Yachts | |
| 15:00 | 16:30 | Ferry | Arrival and departure to Key West |
| 16:30 | 17:30 | Cargo | Particularly the departure of cargo vessels, as window is too short for arrival |
| 17:30 | 22:30 | Cruise ship | Departure of cruise ships |
| 22:30 | 23:00 | Yachts | For yachts that missed the first window |
| 23:00 | 01:00 | Ferry | Departure of overnight trips, arrival from Key West |
| 01:00 | 06:00 | Cargo | |

9. Waste impacts

9.1 Introduction

“Cruise ships represent less than 1% of the global merchant fleet yet it has been estimated that they are responsible for 25% of all waste generated by merchant vessels. This volume of waste produces pressures on the environment, particularly with respect to ship-generated waste disposal at home ports and ports of call.” (Butt, 2007) For Havana’s future situation as port of call (likely) or home port (less likely) this is an interesting development. This chapter will try to capture the essence and impact of waste generated by cruise ships in order to learn from the mistakes from the past and to have a stance on the discussion whether to approve or disapprove development of cruise industry in the bay of Havana.

9.2 Context

The oceans and seas of the world have suffered environmental degradation for many years and the need to prevent further degradation was highlighted by Agenda 21, Chapter 17 at the Rio Earth Summit. A major cause of this degradation is pollution, with the world’s oceans being a receiving area for both land and ship generated pollutants, including waste. Waste can be defined as anything superfluous that no longer has a purpose; be it out of date white goods, food waste, packaging waste, sewage, toxic by-products from manufacturing and so forth. Waste is a global issue that looks set to grow as we enter the 21st century. The problems associated with this waste generation and its management is now high on the political and environmental agendas of many countries and organizations, including the United Nations and hopefully Cuba.)(Butt, 2007)

“Shipping is a cyclical industry that responds to world-wide supply and demand; at present it is in a period of growth across several sectors. One sector that has seen rapid growth over the last few years is the cruise ship market. The growth of this particular market has introduced a unique set of environmental pressures that need to be addressed and investigated, particularly those pertaining to waste management. The world’s merchant fleet consists of approximately 46.222 vessels and it has been estimated that a quarter of all waste is generated by less than 1%

of this fleet—cruise ships. At the end of 2004 there were 441 operational cruise ships, equivalent to 11.5 million gross tonnes, with the average age of the vessels being 21 years. As the cruise market continues to grow, so too will the amount of waste requiring disposal. How this waste is dealt with and the impacts of this waste on the environment will vary according to the waste management plans and facilities at home ports, ports of call and the waste management systems on board individual vessels. Irrespective of these plans, there will be environmental impacts, which have the potential to be

substantial, particularly for small islands, home ports and ports of call.” (Butt, 2007)

The literature describes cruise ship-related pollution as highly intensive (Clark, 2001) and potentially hazardous to the existing tourism in visiting destinations (Klein, 2008). Flexibility and mobility of cruise ships, in combination with the intensity of their impact, create a new and unique phenomenon in (Caric, tourism, and also a problem in environmental protection (Caric, 2010). Cruiser vessels exert their negative effect on the marine environment through various different pathways and in many in-stances management fails to adequately prevent or absorb the environmental damage (Caric, 2010, 2011, 2012). Concerns are being raised regarding the fact that degradation of environmental quality, scenic landscapes, and destinations’ attractions, do not directly affect the cruise companies, as they can simply transfer their activities elsewhere. Furthermore, many stakeholders raised concerns over environmental misconducts cruise companies were either investigated or prosecuted for (Copeland, 2008; GAC, 2000; Klein, 2008). (Cari et al., 2016; Cari and Mackelworth, 2014)

9.3 Cruise tourism and sustainability

It is stated before that the government of Cuba wants to improve the environmental quality of the bay area of Havana. At the same time it is considering to serve as a cruise tourism destination. Questions can be raised whether these two goals can be combined, in other words, if cruise tourism is a sustainable form of tourism.

The cruise industry is a rapidly growing sector of tourism (Butt, 2007). Estimated growth rates for the industry are in the region of 8.5% p.a., with passenger figures expected to reach 14.2 million by 2010. By its very nature cruising cannot be classed as a sustainable form of tourism

because these vessels are incapable of functioning without outside intervention and use significant amounts of resources; consequently they exert great pressure on and generate impacts on the places they visit. Passengers partaking of cruises are invariably attracted to those parts of the world that can be described as 'ecologically vulnerable' or as 'bio-diversity hot spots', which cannot or struggle to assimilate the added pressure that these vessels place on their fragile environments. Another study conducted by (Caric et al., 2016) confirms this paradoxical dependency of cruise tourism "Paradoxically, environmental degradation ultimately decreases the quality of resources tourism is dependent upon."

The Caribbean islands are responsible for the largest share of global cruise tourism. Therefore Cuba and Havana have to decide whether they want to join the tendency of stimulating this kind of tourism at the conventional matter for economic reasons. This seems to be the case if we look at the reference project that this paper uses, but further research could alter that opinion. "

The Caribbean islands are a case in point; with an estimated 44% share of the total cruise market. Alaska, another ecologically sensitive area, accounts for 7.9% and the Mediterranean, a semi-enclosed sea, 12.7% of the market [5]. The strain on the infrastructure of small towns, islands and island groups has in some cases reached acute levels, particularly in the Caribbean and the south Pacific, where efforts are being made to identify strategies that will reduce the environmental impact of increasing number of cruise ship visits. The United Nations Environmental Programme on Small Island Developing States (SIDS) has highlighted the problems being faced by these environmentally and ecologically vulnerable countries and is investigating sustainable solutions [6]." (Butt, 2007)

9.4 Waste and pollution

Discussing about the cruise tourism industry indicates a large waste production. In this sub chapter an overview will be given of the types of waste that one can generally expect when talking about cruise tourism.

Pollutants and waste from cruise ships include air emissions, ballast water, wastewater, hazardous waste and solid waste. It is estimated that an average cruise ship will generate a minimum of 1 kg of solid waste plus two bottles and two cans, per passenger per day and an average of 50 ton of sewage (black water) per day. A figure of 2,5 kg/passenger/

day is quoted by the IMO. Shipboard waste is streamed according to MARPOL 73/78 Annexes I-VI; which govern pollution control and disposal of ship generated waste and prohibits discharges in designated 'Special Areas'. Waste is streamed as oil, hazardous waste, waste water (black or grey), solid waste and air pollution, falling under MARPOL Annexes I, III, IV, V and VI.3 (Butt, 2007)



Figure H.9 Air pollution by cruise ship in Dubrovnik (Caric, 2014)

MARPOL Annex I—oil

Generation of a certain amount of oily bilge water and oily waste occurs on all vessels. It is estimated that a cruise ship generates 8 tonnes of oily bilge water for every 24 h of operation. This water is passed through a separator with 'clean' water being discharged overboard and oil being stored for later disposal. Oil record books, which document discharge and disposal of all onboard oily water and waste, are a statutory requirement for all vessels.

MARPOL Annex III—hazardous waste

This covers all waste that requires special treatment and/or disposal and includes chemicals used in photo-processing, dry cleaning, print shop waste, fluorescent and mercury vapour bulbs and batteries. A cruise ship carrying 3000 passengers can generate up to 68 litres of photo-chemicals per day [3].

MARPOL Annex IV—sewage and waste water

Black water is deemed to be solid human waste and waste from medical facilities with estimates that cruise ships generate between 20 and 40 litres per person per day dependent on passenger numbers. Annex IV permits the discharge of raw sewage on the 'high seas', but only treated sewage may be discharged within 12 miles of land, no discharges are allowed with 4 miles of land. Ships that are members of the ICCL only allow waste that has been treated on board to be discharged at sea in compliance with their standards [3]. Additional discharge restrictions on black water may also be imposed by some individual countries within their territorial waters, under their rights in accordance with UNCLOS articles.

Grey water is deemed to be non-sewage wastewater that results from showers, dishwashing, laundry, etc. It is estimated that cruise ships generate between 120 and 300 litres/person/day. There are no discharge restrictions under MARPOL 73/78 for grey water discharges even though discharges may contain nitrogen and phosphorous and possibly fecal

coliforms. The EU and some other countries do, however, impose their own restrictions for territorial waters.



Wastewater emission of MSC Lirica on 13.10.2006, in front of Old port of Dubrovnik, UNESCO heritage site. Source: dr.Adam Benovic (Caric and Mackelworth, 2014)

MARPOL Annex V—garbage (solid waste)

Approximately 50–70 tonnes of solid waste can be generated each week by a ship carrying 3000 passengers. This waste consists of

glass, tin, plastic, paper, cardboard, steel cans, kitchen grease, kitchen waste and food waste. Generally recyclables are separated and stored for shore disposal or are treated on board (i.e., glass crushing). About 75–85% of the remaining waste is incinerated (dependent on vessel age and facilities), with the bottom ash being discharged at sea when permitted under MARPOL 73/78 or stored for off loading in port. Most plastics are stored for disposal at shore facilities, as there is a total ban on dumping plastics at sea and on incineration of certain plastics [3].

MARPOL Annex VI—air pollution

Whilst it is not generally classified as a ‘true’ waste stream, air pollution is a major by-product of all ships and is relevant to the impacts cruise ships have on the environment. For economic reasons many vessels use heavy fuel oil which has very high sulphur content (90% higher than petrol or conventional diesel). The emissions from burning this type

of fuel include high levels of nitrogen oxide, sulphur dioxide, carbon monoxide and hydrocarbons [10]. Some cruise ships are now looking at alternative, cleaner types of engines and fuels, particularly gas turbines which are very efficient and have low emissions. Cruise ships have a continuous need for ancillary power to meet lighting and ventilation demands both at sea and in port, which is provided by the ship’s generators. Due to technical constraints, such as phasing and high demand, it is not always possible for ships to operate

from a shore power supply, so generators must be run constantly whilst in port which adds to the local environmental burden. Emissions also occur through the incinerator flue gases, particularly if plastics are burnt when dioxins, furans and other heavy metals can be released into the atmosphere.⁴ It should be noted that the EU has recently published a Recommendation (2006/339/EC) that promotes the use of shore-side electricity by ships at berth in EU ports specifically to address issues of air quality and noise pollution at berths located near residential areas.

9.5 Waste policy

Literature stresses the need for proper waste facilities in the ports of call or home ports (i.e. Havana in this study). The need of local policy is emphasized giving more importance to the future stakeholders. “As discussed earlier, in accordance with EU Directive 2000/59, Article 4(2) it is clear that any cruise home port or port of call should provide

adequate waste management facilities to cope with the volume of waste generated by these vessels. How ports deal with this waste will be closely linked to local policy pertaining to land generated waste and to the facilities available to them. Local port policy will, to an extent, also influence how waste is managed on board.” (Butt, 2007) “Most developed countries now use the waste hierarchy in order to encourage a more sustainable approach to waste management. The most desirable option within the hierarchy is reduction (preventative), re-use and recycling (ameliorative and preventative), finally end use disposal (assimilative). The waste hierarchy has worked well in the past, particularly through increased levels of recovery, recycling and re-use, but there is a growing need to take into account the environmental, social and economic impacts of waste strategies based on the hierarchy, where interpretation of the adage ‘prevention is better than the cure’ may be seen as the next step to achieving sustainability [9].” (Butt, 2007)

The aforementioned statement that strong regulation on environmental impact of cruise ships can function as an incentive to alter the status quo of cruise tourism can be confirmed. “Some of the larger operators advocate and encourage high levels of environmental awareness and advertise this fact as an additional incentive when selling their cruises [5]. The ICCL have developed an Industry Standard for ‘Waste Management Practices and Procedures’, which all members have agreed to incorporate into their Ship Management Systems (part of the ISM Code); compliance with this standard will assist in enhancing present cruise ship waste management.” (Butt, 2007) This indicates that local policy indeed can have a positive influence on the environmental impact of cruise ships.

Appendix I - Environmental Analysis

162

1. Definition of 'pollution'

Pollution is the introduction of a contaminant in an environment, causing instability, disorder, harm or discomfort in an ecosystem, in the physical environment or a living being; It is a negative alteration of the initial state of the medium, and usually generated as a consequence of human activity, when the generated pollutant load exceeds the treatment capacity or assimilation medium in which it is poured. There are many causes that can cause it, the main which may be mentioned and which are common to find in an urban context are:

- Insufficient coverage of treatment of liquid waste and inefficient operation of existing systems.
- Final disposal of contaminated surface currents, land and marine waters, and sewage systems and storm drainage liquid and solid wastes.
- Insufficient drainage system or interconnection to it, sewerage.
- The emissions of polluting gases many of greenhouse gases, mainly CO₂ and CO, for stationary and mobile sources.
- Deterioration of housing stock.
- High population density.
- Poor water supply.
- Atmospheric pollution.
- Noise pollution.
- Deforestation.
- Inadequate management of municipal solid waste, including hazardous and inert. (Melorose et al., 2015)

2. History

One of the aspects to be included in this study compared to the reference design is a more thorough understanding of the environment, which includes ecology, flora and fauna. The bay of Havana is a large natural bay and the island boasts unique and diverse flora and fauna. "Cuba is known as the most biologically diverse of all Caribbean Islands. 50% of its flora and 41% of its fauna are endemic (Vales et al., 1998)."

(Maal-Bared, 2006) In order to fully understand the current environmental state of the bay, it is important to investigate the root of this development. R. Maal-Bared and Lane have conducted important research in this field. (Maal-Bared, 2006)

To understand the root of this problem, it is key to take a look at the historical political circumstances. “Ever since the Cuban revolution in 1959, Cuba followed the Eastern Block Paradigm of resource exploitation and environmental domination. While anthropocentric and social issues, such as education, health care, economy and security ranked high on the country’s priority list, environmental issues were of no importance (Lane, 2000).” (Maal-Bared, 2006)

At the time the economic priority was clearly focused on the main contributor: agriculture (i.e. sugarcane and tobacco). “Despite the repeated efforts for diversification, Cuba’s model for development was based on a centralized sugar economy, leaving many sectors of the economy underdeveloped (Figueras, 1992).” (Maal-Bared, 2006)

In 1989 the Soviet Union, Cuba’s most important ally, dissolved and the economic consequences were severe and meant a prelude for the Special Period. “Soviet Block exports to Cuba dropped by about 70% between 1989 and 1993; and the value of all Cuban imports declined from \$8 billion to \$1.7 billion (Garfield and Santana, 1997). Before the economic collapse, Cuba was energy-rich, supplied with cheap crude oil from the Soviet Union, a portion of which was refined and exported again. Oil and sugar constituted the largest portion of Cuba’s exports. After the collapse of its main partners, Cuba was left without fossil fuel. At the time, 98% of the country’s electricity production was fossil fuel dependent and many factories had to close down due to the lack of oil and spare parts (Garfield and Santana, 1997).” (Maal-Bared, 2006)

In the Special Period serious reforms kept the government and economy afloat. “Drastic measures had to be taken to save the country from total collapse; in a period referred to by Fidel Castro as “the Special Period in Time of Peace”. The main economic measures taken by Cuba at the time were: promotion of tourism, curtailment in consumption, selective cutbacks in state spending, implementation of a food self-sufficiency program, legalization of foreign investment and dollar possession (Dello Buono, 1995).” Especially interesting for this study is the importance of tourism for the economy, including its accompanied downsides. Although the population was protected as much as possible, this period resulted

in degradation for the environment. “By the time the Special Period hit Cuba in 1990, the Cuban environment was undergoing very serious degradation. [...] water pollution from domestic sewage, industrial waste, agricultural runoff and drainage, and other point and non-point sources was ubiquitous. The bays were very polluted by anthropocentric activity. Industrial activities posed threats to ecosystem integrity and human health. [...] finally, Cuba had been subjected to serious urban degradation with 70% of its population living in cities, and more Cubans moving towards the western parts of the island (Comite Estatal de Estadisticas, 1998).” (Maal-Bared, 2006)

Eventually awareness about the environment grew among the Cuban government. “After attending the 1992 Rio Summit, the Cuban Government planned on changing its relationship with the Environment. It started with establishing numerous institutions, policies, programs, and laws governing environmental impact assessments, forests, management of protected areas, and environmental education (Lane, 2000). The government also realized the intrinsic link between sustainable development and conservation of natural resources. It turned to organic farming,

renewable resource sources, energy conservation, while applying precautionary measures and clean technologies when possible. Cuba also decreased dumping into rivers and bays, emission of gases into the atmosphere, and overexploitation of water resources (CITMA (Ministry of Science Environment and Technology), 1992). And while many think that this drive towards sustainable development was steered by necessity not choice, the decisions the Cuban government will make over the next several decades could demonstrate their commitment towards this newly found ideology.” (Maal-Bared, 2006)

3. Bad practices

Known sources of pollution are both domestic and industrial.

- Domestic

Because the city's separated drainage and sewage system is in practice not functioning, mixed waste water including feces is directly discharged in the bay area. This is a difficult problem to tackle, since replacing the city's wastewater infrastructure would be very costly. Therefore wastewater plantations are being built

along the perimeter of the bay.

- **Industrial**

Among the main polluting sources are Cove oil refinery “Nico Lopez” factories that produce detergents, cosmetics, degreasers, and the Ministry of Transport, which discarded water scrub with oils.

The pollution in the bay of Havana is an important for the transformation of the bay and has been an ongoing challenge over the last decades. The bay reached such a high level of contamination that it was considered to be the most polluted in the Caribbean region. Therefore, in June 1998 the Executive Committee of the Council of Ministers created the State Working Group of Havana Bay (GTE-BH) and its mission is to design, implement, monitor, evaluate and systematize the Inter-Organization Programme for Integrated Management and Sustainable Development of Havana Bay, its tributary basin and the coastal area of interaction. (Redacción IPS Cuba, 2014) In 1998 they began a sanitation program of the waters of the bay and harbor by means of “characterization” of the waters waste from 99 sources that discharge their waste and cause damage to the environment. (Cubadebate, 2016)

Recovery efforts undertaken by the GTE-BH determined that 124 industries considered “aggressive” environmentally establish plans to reduce discharges, while 53 industries were categorized as “highly polluting”. Although the pollution load has decreased over the last 15 years at 75 percent, much remains to be done, especially from specific actions that can execute sources within its business management, as investments for plants water treatment are costly. (Redacción IPS Cuba, 2014)

According to information provided by Mercedes Gzegotowski, senior specialist of Environmental Management GTE-BH, the total of 106 entities 10 lacking environmental coordinator, only 82 have such policy and only 50 have the Environmental Action Plan prepared in correspondence with the regulations.

Although 41 facilities are allocated in the budget financial resources to take advantage of waste, only 64 percent of the total implemented such actions, he said the specialist, in the meeting held on 19 December.

4. Good practices

Among the good practices is the implementation of actions and stability Productions cleaner (PML) in 57 of the 106 entities that pay taxes to the basin, said Gzegotzewski.

Another experience is successfully applied in the Military Industrial Company Granma, ship repair, where the work of environmental coordinators has improved hygienic conditions and organization that prevent discharges to the bay.

Among the measures taken were from workshops, creating a ship to the tank blasting away from the coast, grease trap cleaning up the replacement of detergent used in the kitchen for a less aggressive and biodegradable.

Another novelty is the pollution tax, which became operational in the last quarter of 2014. The tax increases as the levels of pollutants emitted by the company rise. The money earned by this concept will serve to reverse the current conditions of the roads, he said. (Redacción IPS Cuba, 2014)

5. Results

“From the results, we can see that the amount of environmental damage falls into two categories: a) small-scale environmental destruction committed by individuals through illegal hunting, deforestation, dumping of waste into aquatic ecosystems, etc.; or b) large-scale environmental destruction resulting from major projects and industries approved by governmental agencies and owned by international companies, like hotel chains and mining companies after the Special Period, and agriculture before the Special Period.” (Maal-Bared, 2006) This indicates the importance of a location like the bay of Havana and the major companies that are operating there.

6. Nuance

In order to provide insight in the environmental state of a country a comparative environmental risk assessment (CERA) can be executed as shown by Maal-Bared (2006). This tool can be used by governments and organizations to prioritize the resources (e.g. money, time) on tackling environmental problems. The question remains however, whether tools

like these will make any change in the case of Havana. "Thus, I speculate that the Cuban government will not look into setting environmental priorities using the results of this CERA due to several reasons. First of all, many of the decisions that were made by the government are irreversible. Contracts have been given to mining and tourism companies in a time of need when not much consideration was given to what is environmentally friendly. Secondly, many of the methods that could be used now to reduce negative environmental consequences of some activities would be costly and resources are scarce." (Maal-Bared, 2006) The example also puts the usability of our study into perspective.

The article also addresses one interesting notion regarding the prevention and awareness of environmental problems. As mentioned one of the main priorities for the GTE-BH is education. Again it shows the additional challenges of operating environmental improvement programs in such a complex environment. "Some authors (Houston, 1998; Scanavis and Sarri, 2004) make the claim that environmental awareness would solve the Cuban environmental degradation problem. This claim largely fails to address the reality of the situation. Even if public environmental education resulted in the compliance of individuals (which in itself is questionable considering the scarcity of resources), the major sources of the current environmental crisis in Cuba are the mining and tourism industries, which are controlled by the government. So for example, convincing a local community to provide local guides for eco-tourism projects might decrease the negative impacts of tourism on the bioreserves and increase environmental awareness, as it did in Puerto Rico (Jacobsen and Robles, 1992). It would not decrease the destruction caused by the construction of tourist facilities, transportation of tourists to the sites, and attempting to accommodate a new industry in a region that lacks the necessary infrastructures." (Maal-Bared, 2006)

"It is unclear whether the failings of governmental policy are due to time delays, lack of resources, lack of infrastructure, or the fact that Cuba's environmental issues are not on top of the priority list right now. So far, the Cuban government has made some "environmentally correct" decisions in the fields of agriculture and ecology. The question remains whether the decisions were mainly made by choice or necessity and whether these choices will be enough to sustain the Cuban environment while allowing the Cuban people to survive." (Maal-Bared, 2006)

Appendix J - Reference Projects

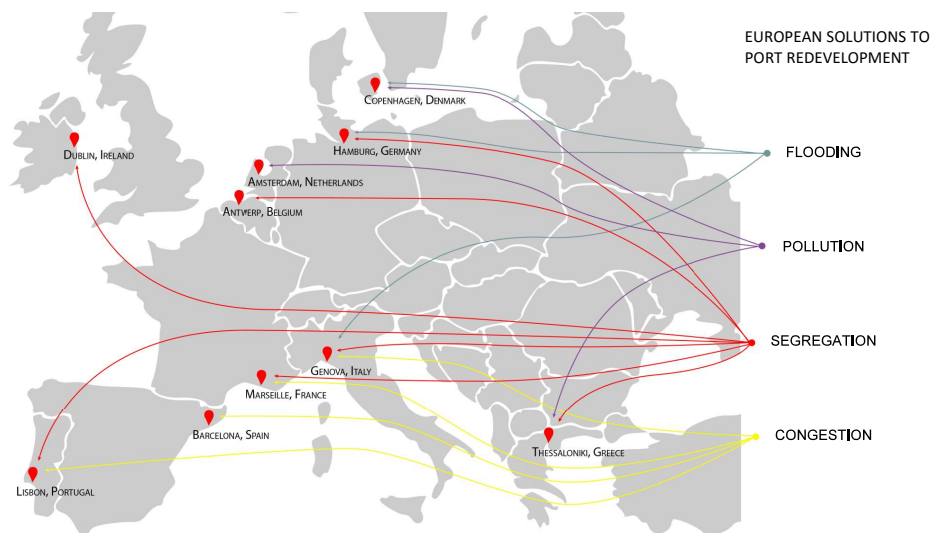
168

1. Introduction

The case of Havana is not an isolated case. Many ports around the world have faced similar situations. Therefore it is interesting to study previous projects both to investigate the process that was applied and the challenges that these ports were facing. This also gives insight in the transitions that are likely and the ones that are more rare.

2. Port transitions

2.1 Overview EMU reference port cities



Many European city ports have recently experienced developments on port redevelopment. The following cities have redeveloped (parts) of their port in order to regenerate urban development.

- Amsterdam, the Netherlands
- Antwerp, Belgium
- Barcelona, Spain
- Copenhagen, Denmark
- Dublin, Ireland
- Genova, Italy
- Hamburg, Germany

- [Lisbon, Portugal](#)
- [Marseille, France](#)
- [Thessaloniki, Greece](#)

Interestingly, many of these ports faced similarities in their challenges. One can see an analogy with the port of Havana where these challenges are also at stake.

- [Cork, U.K. \(\(DredgingToday.com\), 2016; \(GreenPort\), 2014\)](#)
- [Qingdao, China \(\(WaterfrontsNL\), 2016\)](#)
- [Los Angeles & Long Beach, U.S.A. \(Berg, 2014; Middle Harbor Redevelopment Project, n.d.\)](#)
- [Rotterdam, the Netherlands](#)

The port of Rotterdam has been the largest seaport of the world between 1962 and 2004. Also in this port we see the transition of former port areas and redevelopment of public spaces. Furthermore, their latest addition is designed with a strong focus on flexibility, which should be able to embrace future uncertainties better than the former areas of the port.

- [Maas- and Rijnhaven](#)

The Maas- and Rijnhaven were among the first ports on the south bank of the Rhine to be developed after the port had achieved free access to the sea after the completion of the Nieuwe Waterweg. These ports were developed 1887 – 1905 and due to the increasing economic growth were very used intensively. However, over time the function gradually shifted from trade focused port (and cruise tourism) towards a storage-focused port until in the end a port that completely focuses on public space for the city. The former quays are now used for large office buildings and the harbor basin serves experimental projects such as floating housing. (Den Ouden, n.d.; Rotterdam, 2008)

- [Waalhaven](#)

The Waalhaven, developed between 1907 – 1930 was one of the successors and served as transshipment port. The harbor basin was excavated by manually (and still is the largest harbor basin of its kind) and clearly served a social purpose. The

port development created employment for many citizens of Rotterdam. Nowadays the port still hosts container terminals and maritime services and companies. Nevertheless, the south side of the harbor will be redeveloped. “The Port of Rotterdam Authority is redeveloping Waalhaven Zuid into a maritime business cluster. The objective is to create an area with sufficient practical, experiential and future value, which fits in with the port of Rotterdam’s profile as a quality port. In addition to improving the business climate, the Port Authority aims to improve the general environment of the area. To this effect, a project has been initiated to redevelop the public space. “ ((RotterdamPortAuthority), n.d.)

3. Port developments

- Dubuque, U.S.A. (Kautz et al., 2010)
- Tema, Ghana ((NWO), 2016)
- Vancouver, Canada ((PortofVancouver), n.d.)
- Rotterdam, the Netherlands

Maasvlakte 1 & 2

The first port expansion surpassing the natural coastline of the Netherlands took place by the development of the Maasvlakte. The first Maasvlakte was developed between 1960 – 1973 and it focused on expanding the traditional functions of the port, for instance breakbulk and chemical industry. However, in 1966, the first container arrived in the port of Rotterdam and was handled at the Maasvlakte. At that moment of time the layout of the port was not suited for the container handling industry. Therefore, both the municipality of Rotterdam and stevedores had to invest in order to adapt layout, the quays and the terminals. This was only the start of the large growth in container handling industry and its subsequent adaptations to the Maasvlakte. Furthermore, after completion, Maasvlakte 1 remained partially undevelopped for relatively long. This was again due to an incorrect estimation of the market. In hindsight, this could have been prevented if a more flexible port layout was maintained. (V, 2013; Vennix, n.d.)

During the development of Maasvlakte 2, the lessons of Maasvlakte

1 have been taken into account. Therefore, Maasvlakte 2 embraced flexibility, a long-term approach and a multi disciplinary approach in several aspects.

Phased-development, adapting to new trends, large environmental impact assessment, natural compensation, early stakeholder involvement, etc.

- [Sydney, Australia](#)

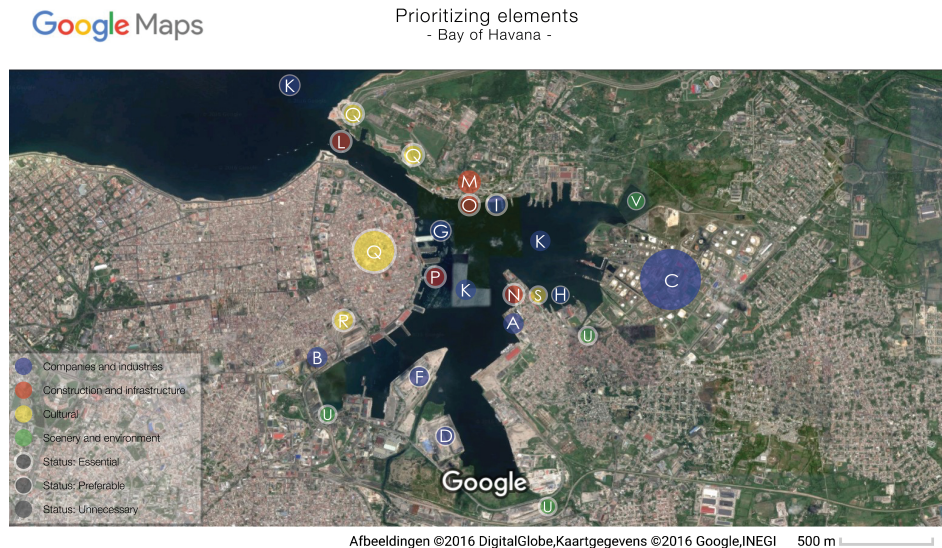
“Sydney Port Corporation (SPC) was established in 1995 as a privatization of State Maritime Board. It contribute to one third of national container traffic. It is operated under land-lord system and lease terminal and facilities to different companies.

The main action to improve air quality is the utilization of ultra-low sulfur which vastly available. Compare to ordinary diesel, ultra-low sulfur diesel in Australia only content 10% of sulfur. Pollution for construction activities is addressed by water spray, re-vegetation, and the use of construction wind break. International Best Practice Report

To reduce traffic congestion, SPC use rail between ports as much as possible, and plan to regulate more stringent freight train emission. This is a partial implementation of 2010 Integrated Transport action plan and NSW Government target to increase share of rail freight to 20% of total national and 40% of container movement in the Botany Port.”

Appendix K - Remaining Elements

172



Companies and industries

- Powerplants

- A. Regla powerplant

The Regla powerplant is not operational anymore. The plant can be seen from many parts of the bay, since it is facing the Old Havana neighborhood. This plant also partially denies the neighborhood Regla access to the waterfront.

Status: 3

- B. Tallapiedra powerplant

The Tallapiedra powerplant is a thermalelectric powerplant in the Atarés area. It is still operational. The location is remarkable, since it is in the midst of the built (residential) environment. It is one of the sources of direct water pollution in the bay.

Status: 3

- C. Oil refinery Níco López

Oil refinery Níco López is currently still operational and also one of the direct polluting sources for the bay of Havana. The terminal has two piers for large vessels (approximately 300 meters) and one small service dock (approximately 100 meters). It is the country's biggest oil refinery with a capacity up to 120.000 barrels of crude oil per day. It is located very

close to the Tricornia wetland.

Status: 3

- D. Container terminal

The Port of Havana Container Terminal

The Port of Havana Container Terminal is supposed to be dismantled, but the latest news expects the terminals to stay in business until at least February 2018. (Miller, 2016) The terminal is equipped with three Panamax ship-to-shore cranes up to 50-ton capacity. Furthermore the terminal consists of eight straddle cranes, two gantry cranes, twelve straddle carriers, eight frontal stackers, three reach stackers and four forklift trucks. Container Lines as CMA-CGM, Costa Container Lines, Crowley Services, ZIM and Holland Maas are supposed to operate with this terminal. The maximum berth capacity is 450 meters long and 9.75 meters deep. This terminal will face large competition from the Port of Mariel. (Roa et al., 2013)

Status: 2

- E. Bulk and break-bulk terminals

The bulk and break-bulk terminals are spread throughout the bay area. In total eight terminals provide some sort of bulk or break-bulk handling.

Status: 2

- F. Ro/Ro terminals

The only Ro/Ro terminal in the bay of Havana is the Haiphong Terminal which has five berths that handle general cargo, containers, scrap metal, lumber, structural steel and vehicles. It has onside rail and truck service. The total berthing distance is 850 meters and the entire terminal has a total area of 22.3 hectares including 2.8 hectares of warehouses and ample open storage spaces. (Roa et al., 2013)

Status: 2

- G. Cruise terminal

The current location for cruise vessels is the Sierra Maestra terminal at the Havana Vieja waterfront. It has three berthing facilities of 200 meters, one of 190 meters and one of 170 meters. The warehouse at this terminal is 2.5 hectares. In the reference project, the cruise terminal is one of the most

important elements to be built in the harbor.

Status: 2

- Shipyards

- H. Marimelena

Most of the shipyards are located in the Marimelena area. Many citizens of Regla traditionally worked for these industries. Because of the decreasing activity in the port of Havana, the shipyards are currently facing an overcapacity.

Status: 2

- I. Navy's shipyard

The Cuban Navy has a shipyard at the Casablanca area. It still is operational and no information exists of the shipyard to be dismantled in the (near) future.

Status: 1

- J. Businesses in Havana Vieja

At the waterfront of Havana Vieja many businesses and organizations are located, the majority focused on the tourism industry, but also organizations like the GTE-BH reside in this area.

Status: 1

- K. Anchorage areas

Three anchorage areas are located in the bay of Havana. In the central area La Tasajera and Casablanca are operational. The third anchorage area is located outside of the entrance channel.

Status: 3

- Construction and infrastructure

- L. Tunnel under entrance channel

A tunnel under the entrance channel connects Havana Vieja and Havana Del Este. For the traffic in Havana this is an important tunnel because the alternative would be to cross the entire circumference of the bay. This would cause more traffic to head through along the Havana Vieja waterfront. Although this tunnel limits the vessel draught to 11.58 m, this causes no limitation for large cruise vessels. For large container vessels

this draught is insufficient.

Status: 1

- **M. Train station Casablanca**

From the train station three times per day trains depart to Matanzas (city 92 km east of Havana). This is Cuba's only electric railway. This train however is in a very bad state so few people use its services.

Status: 3

- **Ferry terminals**

For all ferry terminals a renovation or relocation is necessary. In the status it is assumed that this will take place.

- **N. Regla**

The Regla ferry terminal is currently located at an alternative location since the original construction is abandoned.

Status: 1

- **O. Casablanca**

The Casablanca ferry terminal is located next to the Casablanca train station. The terminal itself is in a poor state.

Status: 1

- **P. Havana Vieja**

The ferry terminal at Havana Vieja provides touristic and forensic traffic to take place with the aforementioned locations.

Status: 1

- **Cultural**

- **Q. Havana Vieja and its fortification system**

A large part of the historic center and the fortification system of Havana is labeled as UNESCO world heritage. This is applicable to the neighborhood Havana Vieja and the castles El Castillo de los tres Reyes del Morro, El Castillo de San Carlos de La Cabana, La Fortaleza de San Carlos de la Cabaña and Castillo de la Real Fuerza. With this special status hardly any adjustments can be made. This means that this neighborhood and the entrance channel must stay unaffected by the transition of the port ((UNESCO-WHC), 2015).

Status: 1

- R. Central train station

The central train station is currently located next to Havana Vieja. Possibly the train station will move to a location south of the bay for future use. The building is labeled as a national monument.

Status: 1

- S. Regla Church

Traditionally many citizens of Regla are devoted to the Santería religion. The church (Iglesia de Nuestra Señora de Regla) is therefore of special interest for the local culture.

Status: 1

- Scenery and environment

- T. Waterfront Havana Vieja

Although only Havana Vieja is labeled as UNESCO World Heritage, from the waterfront of this neighborhood the bay can be observed. With the current industry in operation this can sometimes give ambiguous impressions

Status: 2

- U. Rivers

The rivers Luyano, Martín Pérez and the stream Tadeo are all connected to the bay area. If these sources are contaminated (with domestic waste) this ends up at the bay of Havana.

Status: 1

- V. Wetland Triscornia (Humedal Triscornia)

The Triscornia wetland is located at the East of the bay next to the oil refinery Níco López. Historically this wetland used to be larger.

Status: 2

- W. Fishing harbour

Historically the neighborhoods Regla and Casablanca used to host fishing harbours. With the current pollution this is less common.

Status: 2

- X. Natural banks

One of the features of the bay of Havana is that it is a natural bay where still many natural banks exist. Natural banks can be

an important contributor for natural (re)generation (Sangster, 2015)

Status: 1-2

Appendix L - Project must-haves and should-haves

178

1. Introduction

This appendix provides some background information on the project's must-haves and should-haves. The bay of Havana is a special kind. It has a large natural basin, with many green banks and many former industrial areas that could become vacant in the near future.

2. Must-haves

- Create an equitable, viable and bearable port in order to be sustainable and embrace flexibility (FIGURE three circles).

Whereas traditional port development mainly focuses on the economic feasibility of a project, this framework proposes to simultaneously focus on social and environmental feasibility.

- Focus on tourism on local industry and businesses as main functions.

Although the government of Cuba proposes to focus on tourism only, it should be investigated which other sectors could develop simultaneously. Many citizens living near the bay area used to work for the industry of the port. The new period in Havana's history might create unemployment (especially under women and afro-cubans) that only tourism cannot prevent (Chase, 2016) Furthermore a city only focused on tourism can lead to problems as well (McMahon, 2016; Miller, 2016)

- Improve environmental impact.
 - Impose regulations for vessels to reduce their impacts (waste, operational and use impacts) and provide the facilities for vessels and operators.

Although modern facilities are available to berth cruise ships, it is not (yet) common practice among the Caribbean cruise destinations (Butt, 2007). In order to contribute to the touristic experience and reduce the pollution it is necessary be able to use these technologies. Comparable to the current Environmental Ship Index ((WPCI), 2015) the port of Havana can regulate the cruise market by giving advantages to cruise ships with a low environmental impact.

- **Impose regulation on (remaining) polluting parties**

The many sources of pollution in the bay of Havana need to be solved before the quality of the bay can truly improve, this includes the domestic and industrial waste (water) facilities. ((GTE-BH), 2015)

- **Find a balance between (allowed) amount of tourists and available infrastructure.**

The city has to find its 'weakest link' in the city before it stimulates rapid growth of tourism.

- **Ensure active stakeholder involvement**

Widespread support for the port transition can be ensured by active stakeholder involvement. The responsible port planner have to ensure this involvement.

- **Ensure clear responsibilities for concerned parties**

Although the stakeholders depend on the future scenario,

3. should-haves (nice-to-have)

- **Preserve the characteristics of the natural bay and its historic content.**

These two features are essential for the bay of Havana and should be preserved at all times.

- **Encourage Brownfield development.**

The bay area has an abundance of (former) industrial sites, soon to be left. To maintain the natural characteristic of the bay, it should be stimulated to develop these Brownfields before other Greenfield sites are developed.

- **Create a mix between large, middle and small-sized companies**

A mixture of different sized companies can stimulate to organize the local entrepreneurship market together with the larger multinationals.

- **Encouraging entrepreneurship**

With the country opening up for small and medium sized companies, this new type of economic and social development should be encouraged by the Cuban government.

1. Introduction

In this appendix we will present the background information of the designs. They will be presented according to the same must-haves and should-haves as determined in the previous chapter.

2. Design #1

Must-haves

- Create an equitable, viable and bearable port in order to be sustainable and embrace flexibility (FIGURE three circles).

Since there is a large influence of climate change, the incentive to act upon it is large and approval rates for a conventional design would rise. Hence taking a long time to analyze and design the transition of the bay would be unfavorable as vulnerable parts of the city are likely to encounter the effects already (La Gasse et al., 2015). It is expected to have a focus on economic gain rather than the threefold goal. However, if the government still aspires their initial goal, it could still manage to do so, as the centralized (top-down) governance makes it easier to direct large projects.

- Focus on tourism on local industry and businesses as main functions.

The main focus will likely be tourism.

- Improve environmental impact.
 - Impose regulations for vessels to reduce their impacts (waste, operational and use impacts) and provide the facilities for vessels and operators.

Facilities like shore-power might be built, since even little research indicates the great benefits of such facilities.

- Impose regulation on (remaining) polluting parties

Although some regulation might be imposed, short-term economic perseverance is preferable for the city.

- Find a balance between (allowed) amount of tourists and available infrastructure.

The focus will shift towards individual projects, such as a cruise

terminal or marina, whereas the integral approach diminishes. This causes a discrepancy between capacity and the actual amount of tourists.

- **Ensure active stakeholder and citizen involvement**

This is likely to be neglected since it is not common in the current culture, neither is it encouraged.

- **Ensure clear responsibilities for concerned parties**

In this case the centralized government has more power and general approval to 'overrule' other parties. They direct the project on a top-down manner.

Should-haves

- **Preserve the characteristics of the natural bay and its historic content.**

Although some historic content is protected by the UNESCO World Heritage status, this would not be the focus of the project.

- **Encourage Brownfield development.**

If economically brownfield development is beneficial, this might be an option

- **Create a mix between large, middle and small-sized companies**

The government is likely to keep large companies state owned. Perhaps some multinationals in the tourist market are allowed to host their offices.

- **Encouraging entrepreneurship**

Further encouragement than the middle and medium sized sector is not to be expected.

3. Design #2

Must-haves

- **Create an equitable, viable and bearable port in order to be sustainable and embrace flexibility (FIGURE three circles).**

As a result of the privatization, economic benefits seem to outweigh the social and environmental ones. Due to the noticeable influence of climate change, less time will be allowed for analyses and project preparation. However, more stakeholders will feel the urge to be involved in the (decision making) process.

- Focus on tourism on local industry and businesses as main functions.

The free-market will decide which type of economic will develop in the bay area. Likely, tourism related businesses will appear.

- Improve environmental impact.
 - Impose regulations for vessels to reduce their impacts (waste, operational and use impacts) and provide the facilities for vessels and operators.

If the government still exerts enough pressure to influence the sustainability aspects of the (cruise) tourism industry, measures could be expected. If, however,

- Impose regulation on (remaining) polluting parties

Although some regulation might be imposed, short-term economic perseverance is preferable for the city.
- Find a balance between (allowed) amount of tourists and available infrastructure.

The focus will shift towards individual projects, such as a cruise terminal or marina, whereas the integral approach diminishes. This causes a discrepancy between capacity and the actual amount of tourists.

- Ensure active stakeholder involvement

More stakeholder involvement is to be expected from companies and possibly from opposing parties such as environmental groups and citizens too.
- Ensure clear responsibilities for concerned parties

The responsibility issue is to be taken serious in this case. The government should make very clear policy on who is responsible for which part of the project. Cuba is not used to deal with a shared responsibility project as such, therefore governmental organizations and companies need to be aware of their responsibilities.

Should-haves

- Preserve the characteristics of the natural bay and its historic content.

This will not likely be the focus of the project.

- Encourage Brownfield development.

If economically brownfield development is beneficial, this might be

an option

- Create a mix between large, middle and small-sized companies

It is likely if multinationals try to get involved in the bay area, especially in the tourism sector. Furthermore, local business owners might appear with small or middle sized companies. This could diversify the region.

- Encouraging entrepreneurship

Encouragement of middle and small sized companies is likely. Perhaps even large scale (non-governmental) companies are encouraged to develop in the bay area.

4. Design #3

Must-haves

- Create an equitable, viable and bearable port in order to be sustainable and embrace flexibility

The combination of time and clear governmental control could benefit the outcome of the project. Since the top-down approach is not encouraging stakeholder involvement, the social aspect should be looked after.

- Focus on tourism on local industry and businesses as main functions.

The government has the power to do so.

- Improve environmental impact.

- Impose regulations for vessels to reduce their impacts (waste, operational and use impacts) and provide the facilities for vessels and operators.

The government can set clear regulations and implement facilities for the vessels.

- Impose regulation on (remaining) polluting parties

Remaining polluting parties might encounter increased 'pollution-taxes' or will be encouraged to leave the bay area.

- Find a balance between (allowed) amount of tourists and available infrastructure.

Governmental organizations might impose limits on passenger numbers in order to protect the connecting city. It is possible to carry out an integral design approach.

- Ensure active stakeholder and citizen involvement

Stakeholder involvement will not be encouraged naturally, since this is not common in Cuban culture. If the government desires this, it should be promoted repeatedly.

- Ensure clear responsibilities for concerned parties

The government and its subsequent organizations clearly carry the responsibility.

Should-haves

- Preserve the characteristics of the natural bay and its historic content.

This is possible to carry out due to the integral approach

- Encourage Brownfield development.

This could be done supported by governmental policy.

- Create a mix between large, middle and small-sized companies

This could be done supported by governmental policy.

- Encouraging entrepreneurship

Entrepreneurship will be encouraged or allowed till a certain stage. Large companies are still likely to be state-owned.

5. Design #4

Must-haves

- Create an equitable, viable and bearable port in order to be sustainable and embrace flexibility.

Parties will have to cooperate more for everyone's request to be heard or granted. This is uncommon practice in Cuba as of now. The guidelines from the government therefore have to be very clear.

- Focus on tourism on local industry and businesses as main functions.

The market will develop more or less in a free-market approach. It is likely that this will mainly be tourism related.

- Improve environmental impact.

- Impose regulations for vessels to reduce their impacts (waste, operational and use impacts) and provide the facilities for vessels and operators.

The government can still impose such regulations, but is likely

to encounter

- Impose regulation on (remaining) polluting parties

Remaining polluting parties might encounter increased 'pollution-taxes' or will be encouraged to leave the bay area.

- Find a balance between (allowed) amount of tourists and available infrastructure.

It will be more difficult to regulate the tourist influx. The infrastructure should be part of the integral approach.

- Ensure active stakeholder and citizen involvement

Stakeholder involvement will come more naturally from all sorts of parties. In the first place companies and local business owners are expected, but also environmental parties and citizens might let their voices be heard.

- Ensure clear responsibilities for concerned parties

Since this is a new situation for Cuba, they might experience difficulties in this shared responsibility situation.

Should-haves

- Preserve the characteristics of the natural bay and its historic content.

This is possible to carry out if the integral approach is maintained.

- Encourage Brownfield development.

This is possible to carry out if the integral approach is maintained. If not, economic incentives are likely to prevail.

- Create a mix between large, middle and small-sized companies

This is possible to carry out if the integral approach is maintained. If not, economic incentives are likely to prevail.

- Encouraging entrepreneurship

Entrepreneurship is likely to be involved in many types of companies.

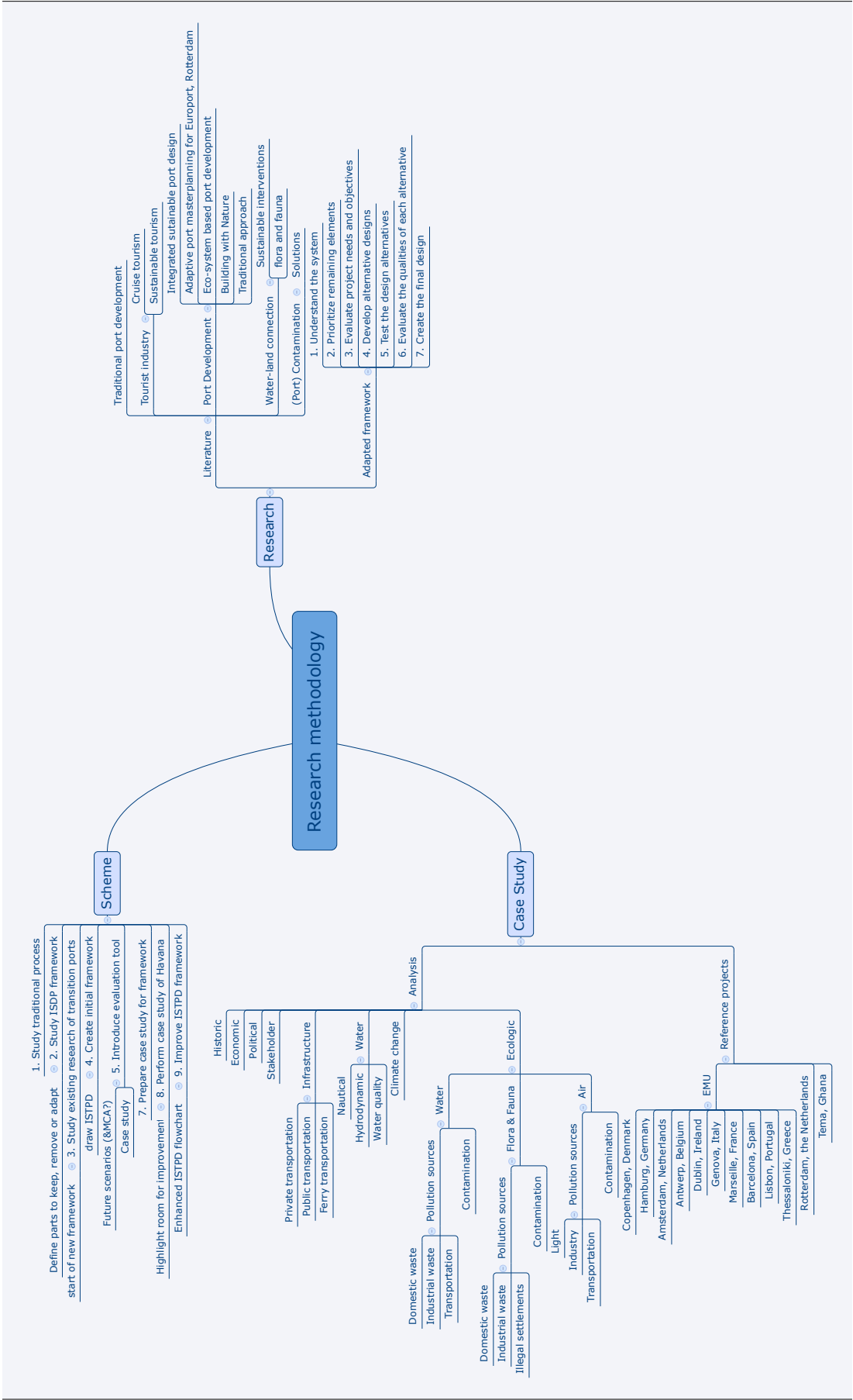


Figure N.1 - Schematic view of the research methodology. (own work)

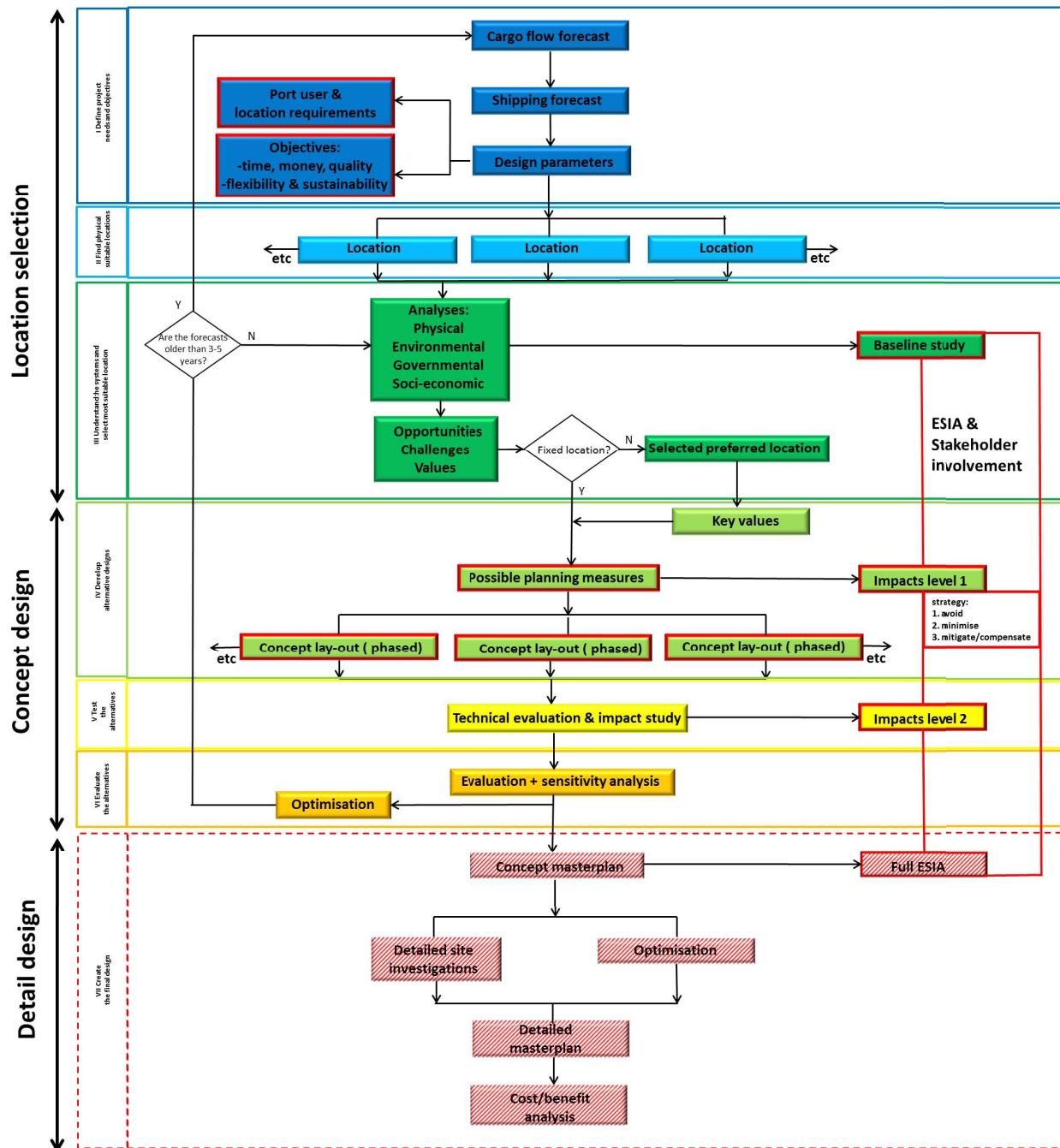


Figure 3-O Flowchart enhanced ISPD framework

The case study in the next chapter will be planned and designed following this enhanced Integrated Sustainable Port Design framework.

