Erasmus University Rotterdam

MSc in Maritime Economics and Logistics

2017/2018

Competitive strategy for Port of Hamburg in container throughput: Analysis of port competitiveness in the Hamburg-Le Havre range

by

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Acknowledgements

The structure and the content of this research have been influenced by many people and I would like to take this opportunity to thank them. Firstly, I would like to thank almighty God for being my guide and strength for writing this research. I would also like to thank my parents for their unconditional love and support.

I would like to express my gratitude to my supervisor, Dr Roy van den Berg for inculcating the research temperament in me, providing valuable suggestions and feedbacks moreover dedicating his time throughout the period I was writing the thesis. I would like to thank Renee, Felicia and Martha for being immensely supportive all through the entire MEL program.

A special thanks to my colleagues Merten Stein, Dr Jan-Henrik Hübner, Carstensen Guido at DNV GL, Hamburg and Mr Alexander Prahl from Eurogate, Hamburg for providing me with the insight required for the research. I would also like to acknowledge the valuable contribution of people for providing the response required for the survey.

I'm privileged to express heartfelt thanks to my friend Firdaus for boosting my spirit and always helping me out in times of need. Last but not the least I'm also indebted to a large number of authors whom I have cited throughout the text.

Abstract

The significance of strategic planning in the context of seaports has become apparent in the recent years owing to the confrontation with the highly competitive business environment. The ecosystem in which the ports operate is dynamic and for gaining a competitive advantage against the competitors it is important to recognise port competitiveness and competitive positioning which are the appropriate aspect of strategic planning. Strategic positioning and benchmarking methods are the tools used to evaluate port competitiveness and competitive positioning. The objective of this research is to analyse the top 5 container ports in Hamburg - Le Havre range focusing on the Port of Hamburg. The ports were evaluated for their competitive positioning and to identify the essential determinants required for achieving a sustained competitive advantage. After having outlined the research, the notion of port competition has been discussed. Various methodologies used in the previous years for analysing port competition is presented focusing on port portfolio analysis and benchmarking analysis which was used later on to perform a quantitative evaluation. The findings revealed that Port of Hamburg is a “Mature Leader” in terms of competitive positioning and its port competitive index is lower than Rotterdam and Antwerp mainly owing to infrastructure feature criteria. Moreover, a survey was also incorporated to find out the perspective of stakeholders regarding the essential determinants and it was revealed that Port of Hamburg needs to make substantial improvements in barge transport connectivity. The research also highlights the areas in which strategy should be improved and incorporated for enhancing the Port of Hamburg’s competitiveness.

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Chapter 1 – Introduction

“Without continual growth and progress, such words as improvement, achievement, and success have no meaning” – Benjamin Franklin.

This implies that productivity is not accidental in nature and mere words like improvement, achievement and success have no meaning unless and until the commitment to excellence, intelligent planning and focused effort is not showcased.

The subject represented in this thesis is port competitiveness with reference to the Port of Hamburg, Germany and containerized cargo. The quest throws light on the identification of essential determinants and port strategy in the above-mentioned port. This chapter introduces impetus of research and will be consequently followed up by the introduction of Port of Hamburg in relation to its main characteristics, its organisation and traffic growth recorded in the recent years. Furthermore, the strategic plan of Hamburg is also outlined briefly, which acted as a stimulus for this study. Subsequently, the aim of the research is illustrated along with the research questions that the study aims to answer. Finally, the chapter is concluded by demonstrating the structure of the thesis.

1.1 Impetus of Research on Port of Hamburg

In the past decades, the port industry and shipping lines have transformed extensively owing to influences like free trade agreements, digitalisation, globalisation, supply chain and logistics evolution etc. There have been changes in operations, management, finance and governance of port as well. Consequently, as the transformations were taking place globally, the competitiveness also enhanced exponentially among the ports industry (The World Bank, 2007). Therefore, in this present scenario, it is very important for the port authorities and operators to recognise the trends influencing the business environment and their competitive position. This would aid them to construct, develop and deploy strategies for improving their business or retaining their competitive advantage.

Since the quantity and involvement of concerned stakeholders are high in container segment, the port competitiveness can be regarded as highly intricate subject matter. The notion of port competitiveness has gained momentum in the last decade. New trends are being developed at a rapid pace especially with the advent of blockchain in the maritime industry (Burns, 2014). Hence, it is very important that these trends are taken into account by the port authorities for strategizing plans and improving port competitiveness.

The approach for measuring the level of port competitiveness entirely depends upon the purpose and intention of this measurement and factors like data accessibility and data quality. This research primarily portrays the methodologies incorporated by the previous researchers in the past literatures finally illustrating the methodology which would be utilized for getting the outcomes to answer the research questions.

As the subject matter of port competitiveness is very intricate and complicated, the impetus of this study aims at answering the root question i.e. Which are the essential determinants that can contribute to sustained advantage for Port of

Hamburg? It is very difficult to standardize the essential determinants of port competitiveness as every port is different and the trends influencing the port industry also keeps on rapidly changing (Haralambides, 2002). The Port of Hamburg was chosen as it had maintained the position of being the second largest container port of Europe in terms of volume (million TEU) until 2015 and subsequently slipped to third place since 2016.

1.2 Port of Hamburg: Gateway to Europe

The Port of Hamburg is owned by Hamburg Port Authority and operated by Hamburger Hafen und Logistik (HHLA) and Hamburg Port Authority themselves (Hamburg Port Authority, 2012). The Hamburg Port Authority performs its operations as an institution under the public law of the port management of Free and Hanseatic City of Hamburg. Hamburg Port Authority is the agency responsible for administering the service for the Port of Hamburg (in charge of leasing out publicly owned land) and is entrusted with the task to develop, maintain and operate the Port of Hamburg. Moreover, some of the priority tasks of Hamburg Port Authority include of safety in shipping traffic, real estate management, port railway systems, water and landside infrastructure and economic conditions in the port.

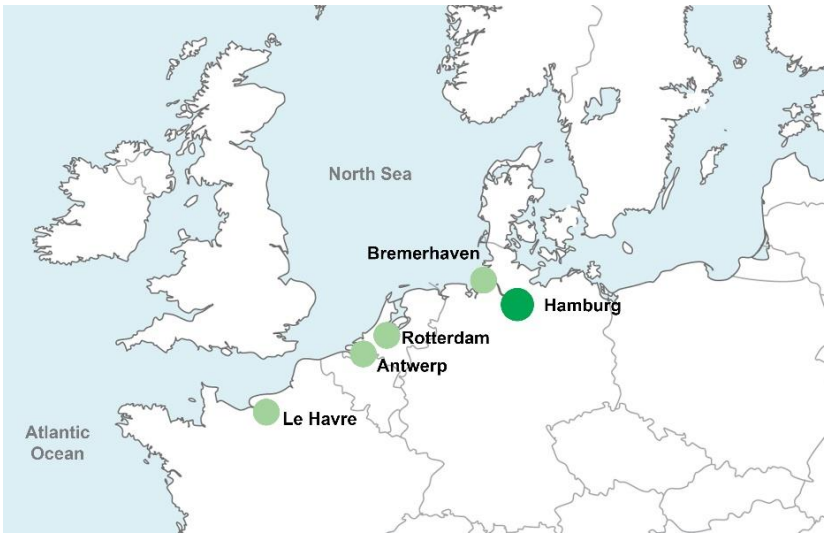

Figure 1.1: Location of Port of Hamburg
Source: (Hamburg Port Authority, 2012)

The governance model which is incorporated at Port of Hamburg is that of the “Landlord Port”. The objective of Hamburg Port Authority is to amplify the social benefits and to enhance the economic and social development of the region served by the ports while making a framework which boosts environment of competition for exports and helps in reduction export costs. This objective has been incorporated in the strategic plan of Hamburg “Hamburg is staying on course” (Hamburg Port Authority, 2012).

The Port of Hamburg is a seaport on the river Elbe in Hamburg, Germany and is located 110 kilometres from its mouth on the North Sea. Its geographical location is close to the open sea and this potentially diminishes the need for less

environmentally friendly road travel which is comparatively expensive as well. This port also enjoys the advantage of being in the proximity of Baltic Sea economic area and Kiel canal as it is located at the extreme eastern end of North Range ports. The expansion of the Kiel canal for accommodating larger vessels will enhance the cost efficiency further.

Figure 1.2: Location of Port of Hamburg (Magnified View)
Source: (Hamburg Port Authority, 2018)

Hamburg also has access to continental railway network as well and therefore it has hinterland connections which are environmentally friendly. The port railways and cross-regional networks are utilized for effective transportation of about 30 % of total cargo volumes managed in Port of Hamburg. Almost 50% of the containers handled by the port are transported by rail over the distances greater than 150 km and 12% of German freight rail transportation begins and ends in Port of Hamburg (Hamburg Port Authority, 2012). Thus, the port is being classified as a hub as it is a delivery and central cargo distribution site. It is a hub for Eastern Europe, Baltic and Scandinavian countries and Russia as well.

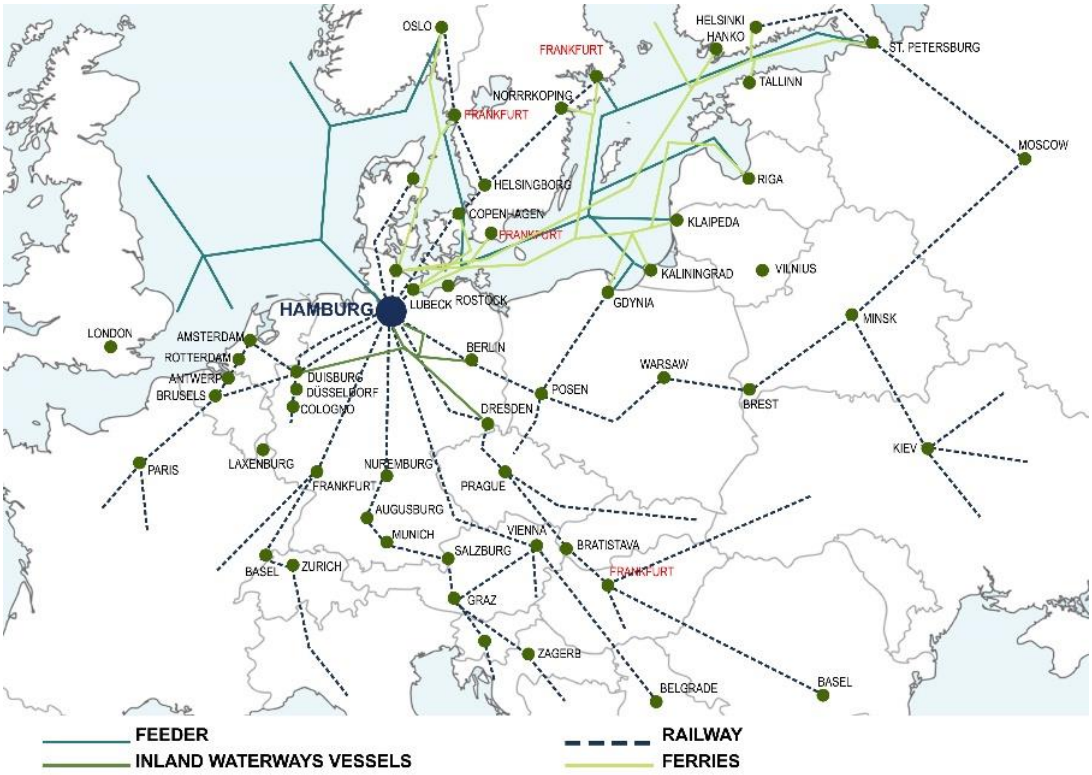

Figure 1.3: Strategic Location of Port of Hamburg
Source: (Hamburg Port Authority, 2012)

Port of Hamburg being a universal port handles all cargo category which includes dry bulk, liquid bulk, general cargo and containers wherein container segment reflects the key strength of the port.

The global financial crisis in 2008 did have a substantial impact on the cargo volumes handled by Port of Hamburg and it is estimated that it resulted in 28% plunging of cargo volumes. However, as the world economies are still in recovery mode and owing to the growth of the Baltic countries and development of Asian economies Port of Hamburg has witnessed considerable progress since the financial fall and at present Northern/Eastern Europe and Asia make up to 75% of Hamburg's container handling (Hamburg Port Authority, 2012).

The South and Northeast region of Asia represents the most significant overseas container trade area as it corresponds to more than 50% of the handled total cargo volumes. In the Hamburg – Le Havre range, Port of Hamburg has a market share of 19.4% in the container segment (Port of Rotterdam, 2018).

As per Port of Hamburg in 2017, 136.5 million tonnes of cargo passed through the quayside including around 8.8 million standard containers (TEU) making Hamburg the third largest container port in Europe and 18thon the list of the world's largest container ports. The universal Port of Hamburg has an average of 18000 calls per year (seagoing and inland), more than 2000 container services weekly, 150 ocean-going liner services and is ready for 20000 TEU vessel (Hamburg Port Authority, 2018). The containerised cargo at the Port of Hamburg is handled by four terminals (1) HHLA Container Terminal Burchardkai (2) HHLA Container Terminal Tollerort (3)

HHLA Container Terminal Altenwerder (4) EUROGATE Container Terminal. Therefore, three terminals are operated by Hamburger Hafen und Logistik (HHLA) and one terminal by Eurogate.

1.3 Strategic Plan – "Hamburg is Staying on Course, 2025"

The Port of Hamburg is a significant source responsible for the prosperity of the whole of Germany and these were the words which were embedded into the Hamburg's constitution in 1952.

> *"As an international port city, the Free and Hanseatic City of Hamburg, due to its history and location, has a special task to perform for the German people. In the spirit of peace, it strives to be an intermediary between all continents and peoples of the world."*
>
> *(Preamble of the constitution of the Free and Hanseatic City of Hamburg).*

It is important for Port of Hamburg to maintain its competitive position for serving the people and for that purpose it needs to make strategic decisions for the future and construct a port development plan for constantly adjusting to the changing framework conditions.

According to the Port Development Act [HafenEG], at regular time period, port development plan has to be presented to the Senate of Hamburg. The most recent port development plan (Hamburg is staying on course) was made by Hamburg Port Authority and was presented to the Senate of Free and Hanseatic city of Hamburg in 2012, after the global financial crisis. The strategic port planning is presented up to the year 2025 as the infrastructure projects which would be incorporated have extended lead times.

The principal objective of this port development plan is to retain/increase jobs in the port industry and enhance value creation in the region of Hamburg. The focus areas in this plan are strategies related to (1) Future Capacity (2) Strategies related to land (3) Transport connections.

This port policy and development plan were made in junction with State Ministry of Economic Affairs, Innovation and Transport and Hamburg Port Authority. It also involves taking suggestions from the experts related to the port industry, environmental associations, chamber of commerce and trade unions. The 4 major strategic guidelines for making the port development plan are related to (1) Value Creation (2) Cargo Handling (3) Quality Leadership (4) Environment.

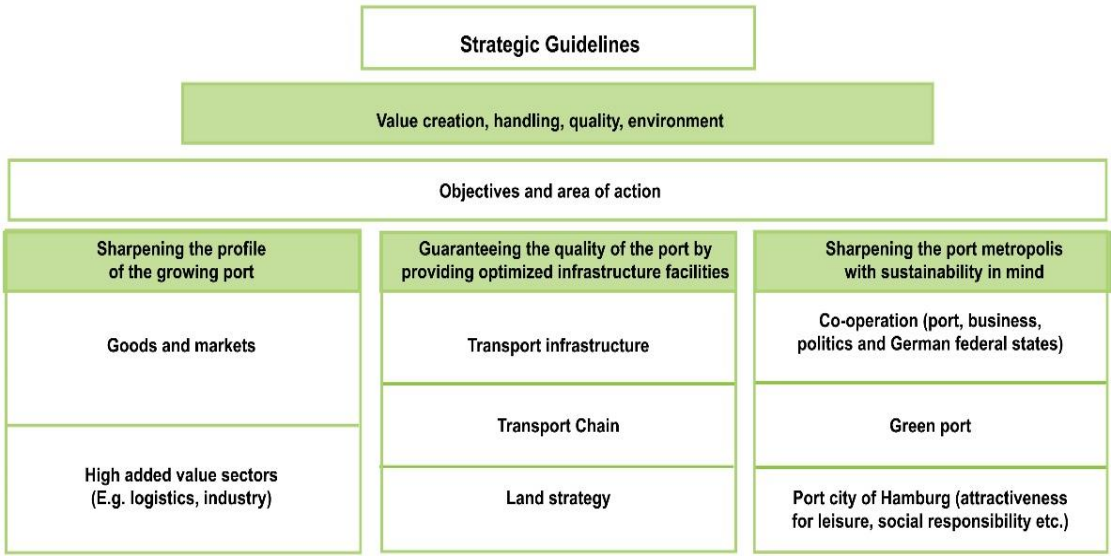

Figure 1.4: Strategic Guidelines of Port Development Plan 2025
Source: (Hamburg Port Authority, 2012)

It is anticipated that the constant growth of counties like China, India, Brazil will surpass Western Europe economy. This surely will have an influence on the volume of trans-continental good flow handled by Port of Hamburg. Therefore, by sharpening port profile the Port of Hamburg intends to secure and expand trade with the growing markets. Moreover, the revenues of Port of Hamburg are largely dependent on value-added services as well and thus, it also aims to enhance relations with value-added service providers.

1) Sharpening of Port Profile includes
   a) Focus on growing market and region
      i) Hamburg's position in intercontinental trade
         - Location offers, Long-term commitment to shipping companies
         - Facilitating the pairing of transport
         - Expanding the function as a hub for the Baltic sea area
         - Maintaining site advantage over Mediterranean ports
         - Improving connections to the Trans-European transport network.
         - Strengthening market relations to North and South America.
      ii) Growth and cargo loyalty opportunity
         - Connecting new growth regions
         - Dedicated terminals
         - Cruise shipping
         - Project Cargo
   b) Committing the value-added industry to Hamburg on long-term basis
      i) Developing the market position in the field of logistics services
         - Value- added services
         - Business co-operation
         - Integrating key players in the transport chain

ii) Strengthening related and attracting new industries.
- Market research and branch screening
- Expansion/ alternative sites
- Providing land for the location of new industries

In the port planning 2025, Port of Hamburg will not only focus on providing state of the infrastructure and transport systems for accommodating goods flow but will also promote environmentally friendly modes of transport like railway and inland waterway. Moreover, creating a smart port with enhanced IT system is also planned in this stage. This will surely help Port of Hamburg maintain a competitive position over competing ports.

2) Ensuring quality of the port by providing optimum infrastructure facilities
   a) Waterside infrastructure
      i) Seaside access to the outer Elbe and Lower Elbe Kiel canal
      ii) Connection to inland waterway network
      iii) Maintenance dredging and sedimentation management
      iv) Nautical aspects and measures in Port of Hamburg's waterway system
   b) Railway development plans
      i) Upgrading hinterland connection
      ii) Port Railways development plan
      iii) Strategic network planning
      iv) Network compaction
      v) Maintenance planning and optimisation
      vi) Increasing the efficiency
   c) Road development plans
      i) Hinterland Measures
      ii) HPA road traffic master plan
      iii) Expansion and restructuring
      iv) Port road management plan measures
   d) New IT system to optimise traffic and logistics flow
      i) Port community system
      ii) Port traffic centre
      iii) Customs and safety
      iv) Smart port 2025
   e) Land strategy
      i) Increasing land use efficiency
      ii) Port expansion to inside
      iii) Port expansion area
      iv) New land development strategies
      v) Strategic development projects

Seaports of Europe including Hamburg have the obligation to formulate strategic plans taking into account the sustainability factor owing to the European Union environmental policies. Therefore, these sustainability initiatives have been planned in close coordination with EU institutions, International Association of Ports and Harbours (IAPH) and the International Maritime Organization (IMO) and the European Sea Ports Organisation (ESPO).

3) Sharpening the port metropolis with sustainability in mind
   a) Cooperation to ensure port success
      i) National and European port policies
      ii) Port cooperation
   b) Green port of Hamburg
      i) Sustainable development of tidal Elbe
      ii) Innovative sustainability concepts
      iii) Environmental and climate protection, nature conservation
   c) Port city of Hamburg
      i) Job quality Guarantor – Port of Hamburg
      ii) Planning tools for fringe areas of the port
      iii) Attractiveness of the port for leisure
      iv) Flood defence

This realistic forecast scenario portrayed by Port of Hamburg depicts constant growth up to 2025 with cargo handling volumes reaching an overall figure of 25.3 million TEU's (12.4 million TEU's in 2015, 17.0 million TEU's in 2020). But, only 8.8 million TEU was handled by Hamburg in 2017 as mentioned in the previous section (Hamburg Port Authority, 2018). Therefore, it can be stated that a moderately optimistic scenario was taken into account considering the assumption that the global economy will continue to thrive until 2025. Moreover, it was considered that demographic growth of Asia (increase in population) and structural growth (global trade functions concentrating in Asian ports) will also lead to enhanced global trade and increase in container traffic volumes.

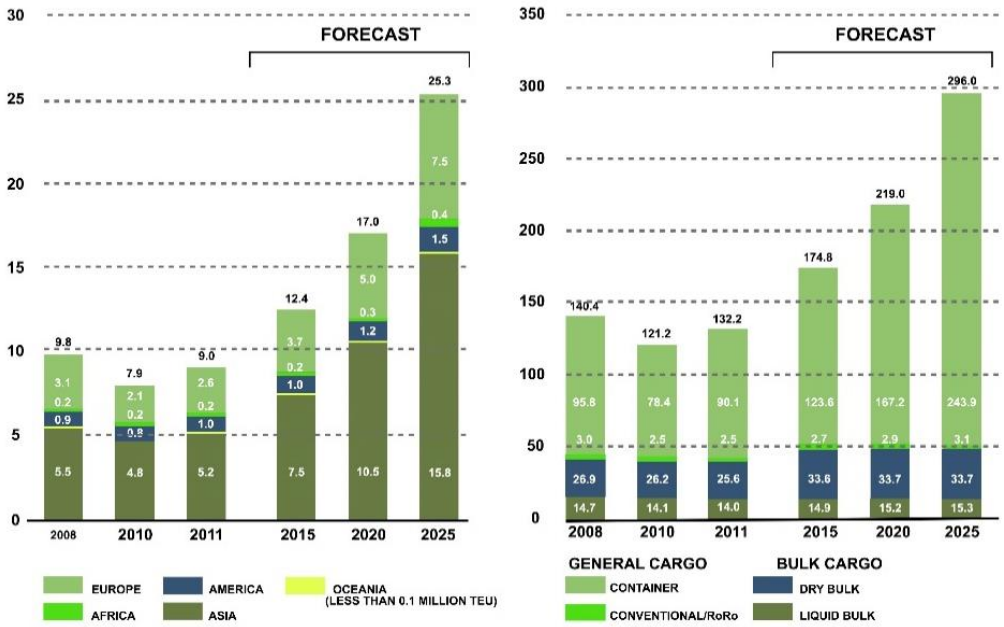

Figure 1.5 (Left) Container handling in the Port of Hamburg allotted as per shipping area in million TEU: actual values and forecast; (Right) Total cargo handling in the Port of Hamburg over the years to 2025 in million tonnes: actual values and forecast
Source: (Hamburg Port Authority, 2012)

Thus, in the coming chapters, we'll discuss whether these strategies are in line with the forecasts and present market trends and also try to look into which other strategies could be incorporated by the Port of Hamburg to retain/increase its competitive advantage in Hamburg – Le Havre range.

1.4 Objective of Research and Methodology

After having looked at the strategic plan of the Port of Hamburg we now delve into this section which explores the objective of the research. The objective of the research is to determine the essential determinants of port competitiveness for the Port of Hamburg. Firstly, we reflect the competitive positioning of all the ports in Hamburg – Le Havre range. Secondly, the fundamental factors responsible for the competitive position of Hamburg are examined in detail. Thus, the goal of this thesis is to add valuable literature to the already existing literature in the area of port competitiveness but with respect to container segment in Hamburg – Le Havre range. This can be surely achieved by performing the analysis as intended and achieving the outcomes of the analysis for answering the relevant research questions.

The research questions based on the present scenario of Port of Hamburg in Hamburg – Le Havre range are: -

"How can the Port of Hamburg maintain its competitive position in Hamburg – Le Havre area with continuous growth of container vessels?"

1) Which macro-environmental factors have a significant impact on the competitive position of the Port of Hamburg?
2) Which are the essential determinants that can contribute to sustained advantage for the Port of Hamburg?
3) What strategy is needed for the Port of Hamburg for container throughput to increase market share and realize the sustained advantage in the Hamburg-Le Havre range?

This research only takes into account the container segment and containerised traffic as Port of Hamburg key strength is in that segment. Firstly, (1) for answering the first research question, existing literatures will be extensively analysed and finally based on credible sources a valid answer will be provided. Secondly, (2) for answering the second research question, Port Portfolio Analysis will be incorporated wherein Port of Hamburg will be compared to Rotterdam (The Netherlands), Antwerp (Belgium), Le Havre (France), Bremerhaven (Germany). Based on the results of the analysis a leader port will be obtained. Moreover, Benchmarking analysis will also be conducted to create Port Competitiveness Degree (PCD) and examine variables and characteristics like infrastructure and services of the ports. The previously considered five ports are again considered for this analysis as well. Apart from that self-administered survey has also been conducted with outcomes of about 50 respondents who can be categorised as professionals and postgraduate candidates associated with the maritime industry. Finally, by studying the results from Port Portfolio Analysis, Benchmarking Analysis and survey along with literatures based on strategic planning and objectives for Port of Hamburg, suggestions would be given by the author.

1.5 Structure of Thesis

The figure 1.6 illustrates the structuring of thesis by the author.

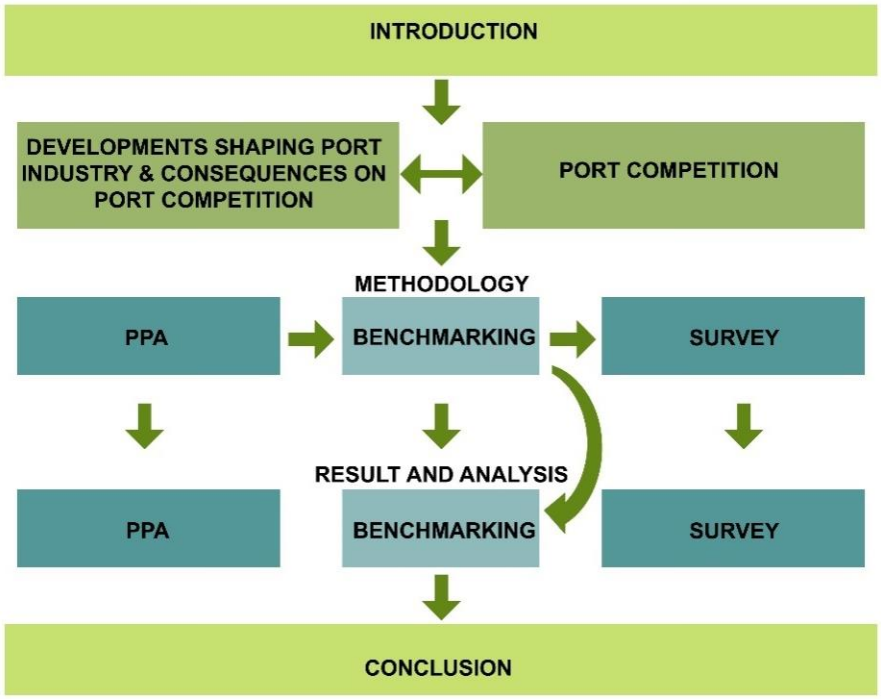

Figure 1.6 Structure of Thesis
Source: Elaboration of Author

Firstly, (1) Chapter 1 introduces the research and also presents the philosophy and the impetus behind the research. It also provides an insight and information regarding the Port of Hamburg and the research questions which have been developed by taking into account the present situation of this port.

Secondly, (2) Chapter 2 presents an overview of the elements that are responsible for modelling the port industry and creating port competitiveness in the last decades. This section is significantly important to recognise how port competitiveness came into existence.

Thirdly, (3) The true meaning and insight about port competitiveness can be understood in this section as it provides multiple definitions and perspective of various authors based on previous literatures. This section also presents the rationale behind studying port competitiveness along with the methods which could have been potentially incorporated for the analysis and the methods which has been actually incorporated. Lastly, an overview of all the significant determinants related to port competitiveness have been illustrated.

Fourthly, (4) The methodology incorporated for this research have been discussed in detail. A) Port portfolio analysis helps to position the ports being compared in the competitive setting. B) Benchmarking analysis is used in the next step to examine deeply with regards to the criteria's which have been set previously. C) A questionnaire is circulated for getting information and insight from the industry experts regarding the essential determinants of port competitiveness.

Fifthly, (5) The outcomes obtained from the chapter 4 by incorporating the port portfolio analysis, benchmarking analysis and survey are taken into account and assessed and studied extensively.

Finally, (6) In this section, the research is concluded, and the author answers the research questions mentioned in the first chapter and finally summarizes the entire study. The author also provides the limitations of the research and suggestions for further research to conclude the thesis.

Chapter 2 – Macro environmental Factors Influencing the Port Industry and Port Competition

Prominent evolution of the port industry has taken place in the last 60 years as mentioned in chapter 1. The contemporary trend to keep growth substantially high, for instance, increase in world trade growth, vessel sizes and modern port facilities are driving investments in ports worldwide (OECD, 2011); (Lam & Notteboom, 2012); (Port of Rotterdam, 2008). The ports have significantly improved in terms of operations, finance, management and governance thus making them much more competitive. The choice for a suitable site for port extension is usually controlled by the administrative borders of that port. There is a growing consensus for sustainable port and sustainable models focusing on society, environment, and economy (ESPO, 2016); (Carter & Rogers, 2008). Thus, competitiveness has been influenced by main factors such as containerisation and globalisation. In this chapter, we explore the influences and the trends boosting the notion of port competition and port competitiveness and as to how they have contributed towards the evolution of this industry.

2.1 Creation of Borderless World

The phenomena of globalisation were placed by many scholars before the European age of discovery and voyages to the new world. But in the 1970's the accurate and current meaning of globalisation was established. Thus, globalisation can be stated as

> *"The process which involves free movement of goods, services and people globally wherein the businesses and other organisations create or develop international influence by starting to operate at an international level"*

In the present scenario, the management of supply chain activities has become more complicated taking globalisation into account. Organisations which have operations in the United States might have facilities for manufacturing in China, India or Mexico and serving customers globally. Globalisation has significantly changed the system in which manufacturers operate and simultaneously provides an opportunity to serve new clients and also exposes firms to extensive competition. There are various advantages and disadvantages of globalisations and the four main driving force of the globalisation process are – Firstly, (1) Global Market Forces. Secondly, (2) Technological Forces. Thirdly, (3) Global Cost Forces. Fourthly, (4) Political and Macroeconomics Factors. Globalisation has also influenced the port industry significantly and various literatures have been published regarding the same for e.g. (Notteboom & Winkelmans, 2001) and (Pinder & Slack, 2004). Due to globalisation trends like containerisation, development of hub and spoke network, the formation of mega-alliances, development of port as a link in supply chain came into existence. Globalisation has also impacted port competitiveness and these notions and trends mentioned above will be discussed in the coming chapters.

2.2 Evolution of World Trade

"The Father of Containerization", Malcolm McLean patented and invented the first shipping container in 1956. Modern container shipping celebrated its 60th anniversary in 2016. The innovation in the maritime sector by McLean was the major force in shaping the world commerce. This method of transport has grown steadily and in just six decades, container ships carry about 60% of goods by value shipped via sea.

The seaborne container trade has rapidly increased from 100 million tonnes in 1980 to about 1.6 billion tonnes in 2014. Moreover, in 2015 for the first time in the records of UNCTAD world seaborne trade volumes were estimated to have exceeded 10 billion tons (UNCTAD, 2016). Shipments have expanded by 2.1 per cent, but unfortunately, the pace has been slower than the historical average. For a decade, the world has been struggling to cope up with the extreme changes and challenges caused by the crash of the financial market in 2008. This has still left large economies in “Recovery Mode” and the issues have not been dealt with in the best way possible. According to the International Monetary Fund (IMF), global exports volumes have grown at an average annual rate of just 2.9 per cent in 2008–15 and it has been less than half the corresponding figure for 2001–08 (Barua & Mittal, 2017).

It can be observed from the figure that in 2015 there wasn’t much growth in the container segment but in 2016, the recorded growth was 3.1% with volumes equivalent to 140 million TEU’s This growth was complimented due to due to factors like positive trends in transpacific trade and increased growth in intra-Asia trade. Moreover, in 2016 volumes projections have significantly improved by 2.9% in transatlantic trade and volumes have reached about 7 million TEUs (Transmodal, 2017).

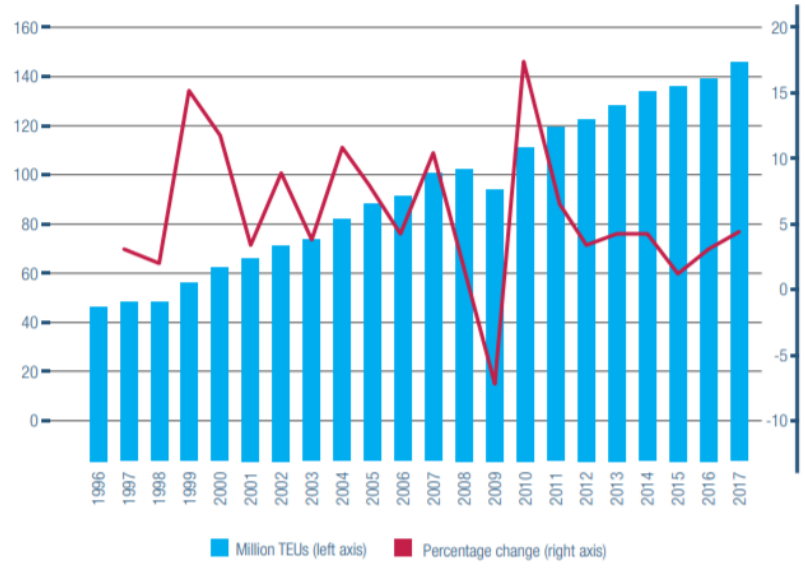

Figure 2.1 Global Containerised Trade, 1996-2017 (Million 20-foot equivalent units and annual percentage change)
Source: (UNCTAD, 2017)

2.3 Economies of Scale and Growth in Container Vessel Fleet

The Shipping Container Industry's long-term trend analysis reflects that the market is cyclical in nature. Therefore, this can result in major shipping lines making significant profits in one year and substantial losses in the next consecutive year. As a result of this, major shipping lines are using the concept of economies of scale by operating Ultra Large Container Vessels to compensate for this effect. Their one and only aim is to considerably reduce per box costs per container which are being handled by them. This has also lead to major reorganisation of Shipping Container Industry which has impacted vital players which includes shipbuilders, shipping lines, terminal operators and logistical facilitators. Moreover, there is a significant reduction in transportation costs and this acts like a major influencer in the strategic decision making of shipping lines however with the increase in vessel size the shipping lines will experience a decline in savings.

The Shipping Container Industry has encountered several transformations in vessel sizes ever since the advent of containerisation. The transformations were driven towards 8000 TEU until 2004 however since the emergence of Ultra Large Container Vessels (ULCV) in 2008 it has been observed that there has been an increase in average tonnage size utilization worldwide. In the present scenario, CMA CGM has 23000 TEU vessels in their order book and major shipping lines have focused their prominence on 18000 TEU vessels.

East Asia – Europe has noticed a significant increase in container vessel traffic and the projected growth up to 2022 is also very high. The largest container vessels have been deployed on this route by major shipping lines. Moreover, the average size of vessels has increased to approximately 8000-10000 TEU which validates the perseverance of the shipping companies regarding the projection growth.

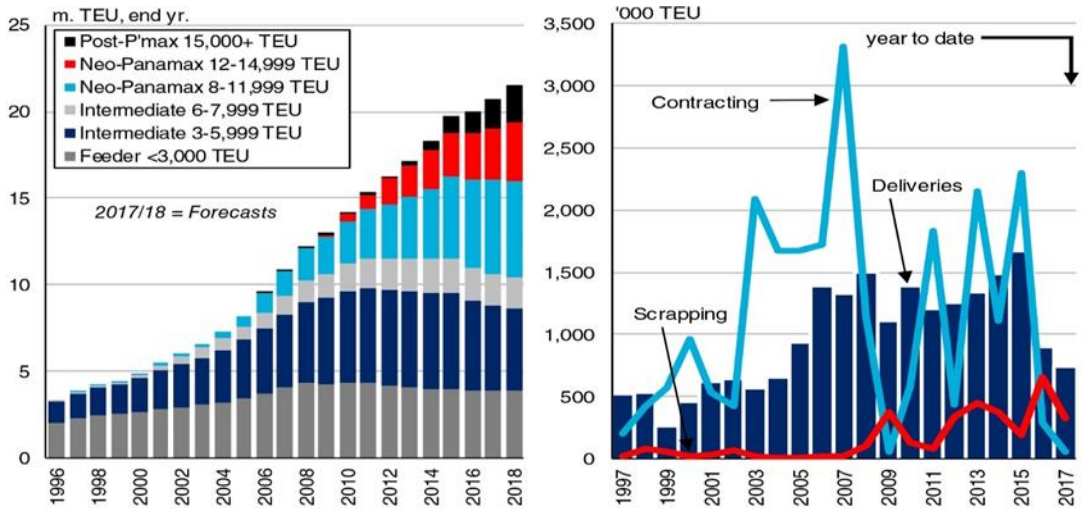

Figure 2.2: (Left) Container Fleet Development; (Right) Container Fleet Trends
Source: Clarksons Research

The strategic decision making of the companies concerning ordering larger vessels has also been influenced by the impact of the Panama Canal. This has led to shipping lines deploying large container vessels for serving the Transpacific trade

route also along with East Asia – Europe trade route. The increase in the average tonnage of vessels which have been deployed has been observed on Transpacific route because of the expansion of the canal. This newly expanded Panama Canal permits passage of vessels having the length overall (LOA) of 366 m, draught of 15 m and breadth of 49 m with a maximum capacity of 170,000 dwt or 12,500 to 13,000 TEU.

The global financial crisis in 2008 was the time-period when most of the shipping lines started getting delivery of new tonnage and this lead to the vessels being shifted to Transpacific and Transatlantic route from Asia - Europe route. This increased the rate at which larger vessels were being cascaded to a secondary trade route. This can be considered as the most significant factors which have influenced the strategic decision making of shipping companies.

However, even after the global financial meltdown in 2008, the shipping companies have gone ahead with the trend of ordering larger ships and in 2017 deployment of 18000 TEU has also been witnessed. This has led the motion wherein 8000 TEU large tonnage vessels have been cascaded to a secondary trade route. Moreover, there have also been differences and discrepancies in the container market with regards to the complications to maximize economies of scale.

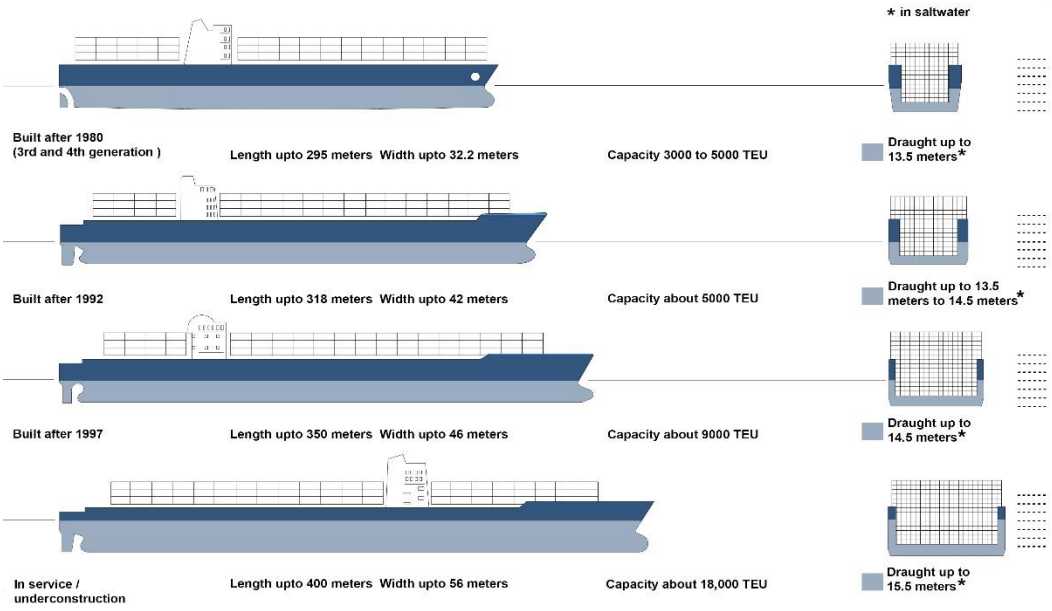

Figure 2.3: Growth in Dimensions of Container Vessel
Source: (Hamburg Port Authority, 2012)

Cost savings will turn out to be insignificant if engine cost analysis is taken into account and the shipping lines need to aim for effective slot utilization onboard to achieve advantages of economies of scale (Wray, 2008). Nevertheless, these studies have not discouraged the shipping lines from increasing their order book by larger vessels. With the current pace set in the market, it can be estimated that 25000 TEU ships can be expected to hit the market by 2022.

Table 2.1: Design Developments of Large Containerships

	TEU's	Length Overall [LOA] (m)	Beam (m)	Maximum Draught (m)	Noted Required Berth Depth (m)
First Generation: 1968	1,100				
Second Generation: 1970-80	2-3,000	213	27.4	10.8	12.0
Panamax: 1980-90	3-4,500	294	32.0	12.2	12.8-13.0
Post-Panamax: 1988-95	4-5,000	280-305	41.1	12.7	13.5-14.0
Fifth Generation: 1996-2005	6,400-8,000	300-347	42.9	14.0-14.5	14.8-15.3
Super Post-Panamax: 1997->	8000-11,400	320-380	43-47	14.5-15.0	15.3-15.8
Ultra Large Container Ship: 2006->	14,500	380-400	56.4	15.5	16.4
New-Panamax: 2010	12,500	366	49.0	15.2	16.1
Triple E-Class	18,270	400	59.0	15.5	16.4
CSCL 18,400 Class	18,400	400	58.6	15.5	16.4
MOL Triumph	20,170	400	58.8	16.0	17.0

Source: Clarksons Research

Larger vessels have also significantly impacted the terminals and ports immensely. Therefore, as the larger vessels are deployed on trade routes it has been observed that there are fewer ports than expected which can effectively handle these large vessels. In order for the terminals to handle these mega carrier's huge investment is required for developing and constructing facilities. It is anticipated that the ports which are unwilling to make such investments will fall behind and will lead to them losing significant market share.

For handling these mega carrier's some of the facilities which need to be developed by the terminals and ports are: Firstly, (1) Increasing the depth and width of approach channel and berth area also keeping the criteria of the requirement of a larger turning circle. Secondly, (2) Increasing the yard space as the terminals will need to handle increased transhipments and would also result in increased gate pressure. Thirdly, (3) Installing bigger and heavier gantry cranes which have booms that can reach and work throughout the beam of the ships. Also keeping the criteria of the requirement of a heavier electrical load. Fourthly, (4) The development of supplementary infrastructure is also equally important like warehouses, larger inland container depots and refer storage area for attracting major shipping lines and alliances.

However, even after making such huge investments there is a possibility that major shipping lines and alliances might exert immense pressure on ports by pretending to shift their cargo for receiving attractive rates and services.

2.4 Formation of Mega- Alliances through Horizontal Integration

With the developments related to agreements like vessel sharing, formal alliances and swap slot among the shipping lines, have led to the effective utilization of carrying capacity for larger vessels. This also presents the shipping lines with similar economic principles to gain access to each other's slot on vessels. Thus, it can be stated that economies of scale have led to the formation of mega-alliances.

Consolidation of alliances was the only way through which the shipping lines could have engaged in sharing vessels and slots.

These alliances agree to have vessel sharing arrangements in certain trade routes and also engage in joint negotiations with terminal operators for providing them with attractive rates. However, such alliances have also negatively impacted the shipping container industry as the shippers have run out of booking options and have led to terminating alternatives. This has provided the alliances with the upper hand and thus providing them with the ability for manipulating the freight rates for increasing their profit margins and revenues.

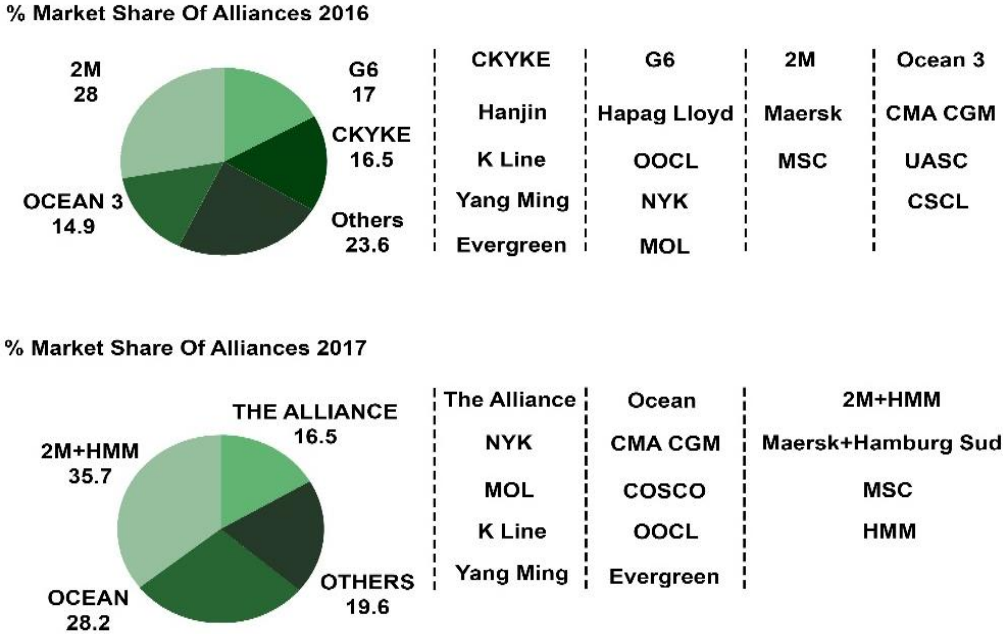

Figure 2.4: Market Share of Alliances (%)
Source: Elaboration of Author based on Alphaliner,2017

These pie charts clearly illustrate the present scenario that the shipping container industry is extensively concentrated as compared to the past. It can also be observed that the market share of major 4 alliances (G6, CKYKE, 2M and Ocean 3) was 76.4% at the end of 2015. Subsequently, the market share of major 3 alliances (HMM+2M, The Alliance and Ocean) was 80.4% in 2017. In 2015, the alliances comprised of 16 companies and in 2017, the number dropped down to 11 (Alphaliner, 2017).

This greater level of mega-alliances which have been acquired through horizontal integration has unclear effects on the port competitiveness. But it is for certain that major shipping lines have attained larger market power and power to bargain against other stakeholders involved. Globally, the port authorities have had different viewpoints regarding this trend. But the overall impact of mega-alliances on port competitiveness can also be explored for further research.

2.4.1 Emergence of Hub and Spoke Network

The organisation of shipping line networks has been developed and revolutionised due to increasing trade activities around the world and economies of scale. Major shipping lines initially focused on the west to east route and then shifted attention towards south to north route for expanding their services globally. The cascading effect mentioned in the earlier section also led to the reorganisation of shipping line network as larger vessels were deployed on other trade routes apart from the trade route on which they were intended to be used. Mega-alliances also contributed towards the reorganisation of shipping line networks as the shipping lines started sharing each other's resources. Finally, as ports realised their significance in transport and distribution chain, the creation of the hub and spoke network took place. All these factors added towards the reorganisation of shipping line network thus facilitating better coverage globally.

This network has been effectively utilized by the shipping lines wherein the network consists of elements like hub port, lateral port, main trade route and branches (Rodrigue, Comtois, & Slack, 2009) and big vessels halt at hubs on main trade route, consequently the transhipment takes place by a smaller vessel or land-based transport towards the end destination. This practice has categorised some ports as the hub based on the characteristics (such as infrastructure and services) it possesses. This led to increased traffic in specific trade routes as the shipping lines started operating in the hub and spoke network arrangement. Moreover, certain ports also lost their market share because of not being classified as a hub port. But it is not necessary that if the port possesses the characteristics it won't be out of the market. In fact, if the reorganisation of shipping line network takes place, there is a possibility that even though port possesses the necessary infrastructure and service facilitates still it will lose market share. Thus, it can be stated that the hub and spoke arrangement functions and complements the advantages of shipping lines and leaving the port industry to face consequences of the strategic decision making of shipping lines.

2.4.2 The Growth and Expansion of Terminal Operators Globally

Similar to the concept and practice of mega-alliances involving shipping lines which is part of the horizontal integration, there is also alliances taking place in terminal operations. It has been observed that there is an increase in the trend wherein container terminal operations are passed on to global terminal operators. Companies like Port Authority of Singapore, Hutchinson Port Holding, APM Terminals, DP World etc have transformed the container terminal operations all around the world. These global terminal operating companies have been highly successful in generating profits as compared to other sectors of the maritime industry (Brennan, 2002). They have effectively utilized resources such as capital and expertise to construct a complex and productive terminal management structure. They have eliminated local terminal management operators and have exponentially grown within the previous decade while incorporating multi-user criteria.

This definitely reduces the role of local participation in the operations as some researcher's state that global terminal operators have taken control of the

management from the port authorities and the port authorities have submissively given up. There have been occurrences wherein the strategic interests of terminal operators are not in line with that of the port authorities. This has resulted in unknown effects towards port competitiveness. Therefore, the port authorities need to take into account the aggressive expansion strategy of global terminal operating companies which strategize mostly focusing on profit and not value-added for the region.

2.5 Vertical Integration and Aggressive Approach to Port Competitiveness

In the previous section, we explored the horizontal integration and its significance on the port competitiveness. In this section concept of vertical integration will be explored. The shipping lines aggressive approach towards vertical integration will be discussed and emphasis will be laid on the fact that horizontal and vertical integration both affect the port industry.

2.5.1 The Progression of Dedicated Terminals

Globalisation has led to shipping companies striving to provide the best facilities to the customer which includes door to door services. Thus, shipping lines wanted to make a major shift from ‘port to port’ based service and provide ‘door to door’ based service. Therefore, the shipping lines have focused their attention on gaining influence over the transport chain. For acquiring this influencing power major shipping lines started establishing dedicated terminals. This trend started off in the United States initially and it spread across Europe. The best examples for dedicated terminals are MSC terminal in Antwerp and Maersk terminal in Rotterdam.

Many researchers have discussed in great detail regarding the issues of dedicated terminals and their positive impact as well. Avery (2000) and Haralambides (2002) have stated reasons in their research which include a reduction in the number of links in the distribution network, increase in effective productivity and lastly significant cost-savings.

The notion of dedicated terminals has also had a significant impact on port competitiveness. This has led to the increase in the market share of shipping companies and also led to occurrences wherein monopolies were established by the shipping companies for using this infrastructure. Sometimes, even the shipping lines did not prefer their vessels being handled by the competitors’ terminals which lead to the port losing lot of customers. There is also a threat to the previous capital invested by cargo handlers as such dedicated terminals can also lead to major rearrangements of activities. Therefore, it is very important to consider these factors before the port authority takes the decision of allowing a shipping line to develop a dedicated terminal.

2.5.2 Paradigm Shift from “Door to Door” to “One Stop Shop” Concept

The shipping lines have become more and more aggressive in their strategic decision making for creating a door to door service for their customer. These strategic decision makings are in their own vested interests which mainly include

expansion of the business and gaining market power. After incorporating the concept of “door to door” service by making investments accordingly, shipping lines have also started to focus on “one-stop shop” concept of service. For one-stop shop services shipping lines have vertically developed their activities across inland distribution networks and logistics services as well. The notion of one-stop shop is as similar as of door to door service i.e. increased dominance over transport and distribution network.

Thus, both horizontal and vertical integration affect the port industry directly because of the growing influence of terminal operators in the logistics sector and expanded operations in the inland sector. These integrations also affect indirectly as they affect the marketing strategy of the ports and port competition.

2.6 Types of Port Governance Models

It is also important to discuss the significance of port governance on port competitiveness after having discussed horizontal and vertical integration. Brooks & Cullinane (2007) have stated in their research that decentralization of port management function leads to an increase in the customer-centric and commercial approach towards port competitiveness and this has enhanced the overall existing competition in the industry. Evolution of the conventional port governance started taking place by privatisation in the 80’s and 90’s. This evolution was much needed globally as ports posed as a restriction for rapid moving cargo. One of the major factors being not adapting to automated growth because of strict labour laws and intervention of labour unions. In certain circumstances and situations due to laid-back government policies, even the port authorities were reluctant towards the development of infrastructure wherein such investments and initiatives were required to keep the port in a competitive position. Due to these factors, the government encouraged incorporation of privatisation in operations and management of ports and terminals. This lead to the evolution of port governance.

It is noteworthy that privatisation was not incorporated not only to increase port competitiveness, but it incorporated to keep up with the pace of the trends emerging globally. But there have been discussions regarding this issue as well because some argue that privatisation has led to making operations more efficient. It has also given rise to new stakeholders and market players. De Langen & Pallis (2006) have stated that the development of intra port competition was also subsequently created due to privatisation. Therefore, some researchers support the claim that privatisation has increased port competitiveness. There are different types of the port governance model and some include leasing, management contracts, corporatisation and even complete privatisation. The figure 2.5 illustrates the port governance models existing globally:

TYPE	INFRASTRUCTURE	SUPERSTRUCTURE	PORT LABOR	OTHER FUNCTIONS
PUBLIC SERVICE PORT	PUBLIC	PUBLIC	PUBLIC	MAJORITY PUBLIC
TOOL PORT	PUBLIC	PUBLIC	PRIVATE	PUBLIC / PRIVATE
LANDLORD PORT	PUBLIC	PRIVATE	PRIVATE	PUBLIC / PRIVATE
PRIVATE SERVICE PORT	PRIVATE	PRIVATE	PRIVATE	MAJORITY PUBLIC

Figure 2.5: Types of Port Governance Models
Source: (The World Bank, 2007)

2.7 Port – Backbone to Supply Chain

Like the notion of types of integrations in the maritime industry, there have been various other notions that have been put forward in the past decade which have had a significant impact on the maritime industry in general.

In the 70's and 80's ports were considered to be a highly significant factor which has the potential to aid for the growth in increasing the regional and national economy, production factors, output, employment and income. Moreover, due to the advent of globalization and containerization in that period, the experts had recognised the ability of the ports to contribute towards it thus boosting international trade. Therefore, ports were considered to be one of the most important elements which could create value and boost the economic growth of the hinterland they cater to.

Due to these changes taking place globally and most of them revolving around the port industry, a lot of studies was carried out by researchers on the port service and infrastructure section. But, until this point, there was no concept of the port industry being an integral part of the transport chain and the overall supply chain. Some researchers have also compared the port to be an integral part of value-driven chain system. Robinson (2002) has stated in his research work that the port is a vital part of value-driven chain and provides the value of shippers and 3rd party service providers thus increasing their own potential and value along with that of the entire chain. Bichou & Gray (2004) have stated in their work that ports act like a junction wherein convergence of logistics, supply and trade channels take place. Therefore, it can also be concluded that the ports are vital elements not only in the transport chain but also play an important role in the logistics chain. Hence, ports can be termed as not only a node but also a link in the entire supply chain. De Martino (2008) also, has shared a common notion regarding port as a link in the supply chain in his research work. He states that port cluster behaves like being part of a larger organisation wherein several segments of the organisation like logistics and transport combine forces to provide the best service possible to the customer. This, in turn, creates a value addition and creation for the whole chain wherein the customer is benefitted the most out of it. At the same time, the organisations in the supply chain consider productive value addition if at all the customer is prepared and ready to compensate for the services being provided. Thus, the ports have created immense value addition by assisting and backing distribution, manufacturing and procurement of goods.

The supply chain has created a new outline for the port competitiveness. The ports competitive positioning is very much dependent on the entire supply chain structure related to that ports rather than just looking into the infrastructure and services provided by each port (Martino, Marasco, & Morvillo, 2012). Therefore, the ports' link to the supply chain can be considered as that critical element which plays a major part in determining the competitiveness of a particular port. Some researchers such as Robinson (2002) have stated a very strong view that competitiveness is not taking place between the ports but is taking place between the entire supply chain. He believes that in this way the ports are not competing on the basis of their characteristics like infrastructure and services, but the entire supply chain is competing to deliver value-added services to the shippers. But researchers such as Song & Panayides (2002) have an opposite viewpoint as compared to Robinson (2002). They state that, though definitely the port as a link in supply chain adds value but the port authorities also need to take initiatives for development of technology and data sharing, maintaining relations with shipping lines integrating different modal splits. These initiatives can make the port a stronger link in the supply chain and can boost their competitive advantage.

2.7.1 Integration of Ports along with Inland Connections

It is significant to realise and recognise the potential of the port which pioneers in serving both land and waterside efficiently as the hinterlands which the port serves are the backbone supporting the competitive advantage of the port. While providing door to door service the highest cost can be experienced in the inland section with almost about 40-80% of the entire cost of transport of goods. Therefore, efficiency has to be gained in the land side as well otherwise the productivity achieved in the waterside by mega-alliances and economies of scale will be lost due to the inefficiency of landside. This will definitely help the ports to retain and develop the relationship with the shipping lines and become the favoured destination for cargo operations. This can improve the modal split efficiency of a particular port and would act like a perfect link between sea, barge, rail and road (Hamburg Port Authority, 2012).

2.8 Cluster Viewpoint Approach towards Ports

In the previous sections we have discussed the role of ports as a node in the supply chain but in this section, we explore the notion of ports from a cluster viewpoint which can be considered as an extension to the previous notion. The importance of this perspective as increased in the recent years and a lot of research is being done on this topic as well. This notion gained valuable input initially from Haezendonck (2001) and De Langen (2004) and moreover both authors collaboratively researched the topic together as well De Langen & Haezendonck (2011).

Haezendonck (2001) studies port competitiveness by analysing and doing detailed research on notion of port clusters whereas De Langen (2004) studies port governance by performing detailed analysis on the notion of port clusters. Other researchers such as Brett & Roe (2010) have also investigated the port cluster for the region of Dublin. Thus, many researchers have illustrated the notion of the port cluster by incorporating them for analysis of a particular region rather than

accurately defining it. As a result, there is no fixed definition for the same. But by examining the approach and the perspective of all the researchers towards port clusters we can come to a conclusion that this notion is quite intricated and complicated at the same time.

De Langen & Haezendonck (2011) both authors collaboratively agree that port cluster notion is multifaced and composite, but they state that this notion can be incorporated in port industry and will be extremely beneficial in delivering accurate understanding about port governance, port competitiveness and determinants of port competitiveness. The authors also provide explanations and validations for the above statement: Firstly, (1) Intra-cluster competition notion can be used to analyse intra-port competition and therefore, the port cluster notion can be used to examine port competitiveness. Secondly, (2) Haezendonck (2001) in her research states that value-added ton dimension should be used to analyse the notion of the cluster similar as to when throughput volumes are considered while analysing port competitiveness. Thirdly, (3) The significance related to the relationship between the inter-dependent firms in the cluster cannot be underestimated as various inter-dependent firms add towards overall competitiveness of the port. Lastly, (4) The function of port authority in the capacity of a firm imposing dominance in the port cluster can be discussed as well.

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Table 2.2: Notion of Port as Cluster and Transport Node

	Port as a transport node	Port as an economic cluster
Definition	The gateway through which goods are transferred between ships and the shore.	An economic complex consisting of all firms related to the arrival of ships and cargo and located in one region.
Performance indicator	Throughout volume.	Value added in the port (cluster).
Analytic models for analysis of the role of the government	Classification landlord, tool port and service port.	Port authority as the central organization in cluster governance.
Frequently mentioned performance variables	• Maritime accessibility • Geographic location • Hinterland connections	• Intra-port competitions • Knowledge spill-overs • A qualified labour pool
Research issues	• Development of liner network structures. • Hinterland accessibility as determinant of port competitiveness. • Factors influencing terminal efficiency.	• The effect of institutional arrangements on port competitiveness. • Ports as logistics, trade and production centres. • Clusters of ports in proximity. • Green ports and port's social responsibility.
Geographical focus	Specific terminals	Geographical and institutional proximity of actors in ports

Source: (De Langen & Haezendonck, 2011)

2.8.1 Functioning of Port Clusters

There have been various studies on port cluster globally. It is very difficult to allocate an outline for examining port cluster which has been constantly transforming in the past decade. But few examples of port clusters are Dubai, Hong Kong, Netherlands (Dutch maritime cluster), Singapore and London. Some researchers have addressed port as a firm and stated that the port cluster is a firm wherein there are transfer and distribution of goods along with logistics services, process related firms and administrative management body. These researchers emphasise the importance of the port cluster in modelling port competition and also stress that added value also is very significant while considering the functioning of the port cluster.

2.9 Chapter Conclusion

In this chapter, we explored that how port operations, governance, finance and management take place and which factors and elements influence them. Subjects like globalisation, economies of scale, vertical and horizontal integration, hub and spoke shipping line network, port privatisation has been deeply discussed by reviewing existing literatures.

Therefore, it can be concluded that these subjects mentioned in the previous paragraph have deeply influenced the port competitiveness and it has resulted in the ports trying to acquire effective productivity. Moreover, the ports have been affected severely because of the horizontal and vertical integration in the transport chain. Subsequently, privatisation has major influence behind boosting port competitiveness and therefore as the stakeholders increase the evaluation of port competitiveness gets more intricate and complex. In the next chapter 3, the author examines various literatures on port competition and explains the notion behind it.

Chapter 3 – Port Competition as Pillar to Sustained Competitive Advantage

In this chapter, the study focuses on the port competition itself after having evaluated the trends modelling port competition. This chapter aims to define port competition by accessing various literatures available on the same. Also, port competition at individual levels is described along with illustrating the difference between port competition and port competitiveness. Moreover, the significance of research on port competitiveness has also been explained along with the enumeration of methodologies accessible to measure port competitiveness used by the maritime industry. Lastly, based on theoretical findings, the determinants of port competition have been elaborated.

3.1 Perspective about Port Competition

Seaport Competition has a complex nature and that, because of this complexity, it has been recognised as a term which can be interpreted based on various definitions Verhoeff (1981). Verhoeff was the first academician who had taken up the affair of port competition back in the 1980's and truly understood the complex nature it. He states that:

> *"Seaport competition is very much talked about, but seldom is it thought about deeply. It is usually referred to in rather general terms such as 'the' competitive position of port X, 'the' competition between port X and Y and 'the' competition in port Y. Seaport competition has a complex nature and that, because of this complexity, it is inappropriate to speak of 'the' competition. Great care and clarity are necessary to identify and classify this competition."*

Verhoeff (1981) further explains the reason behind the complexity owing to the factors like market features related to port service, geographical levels at which competition takes places, the economic framework of port ranges etc. This literature significantly persuaded more researchers to take up the topic of port competition but at the same time, it doesn't present an accurate meaning for the same. His concept of seaport competition models a framework where there are three distinct geographical levels.

- Within Port Range
- Within Ports Areas in Port Range
- Within Ports in certain Port Range

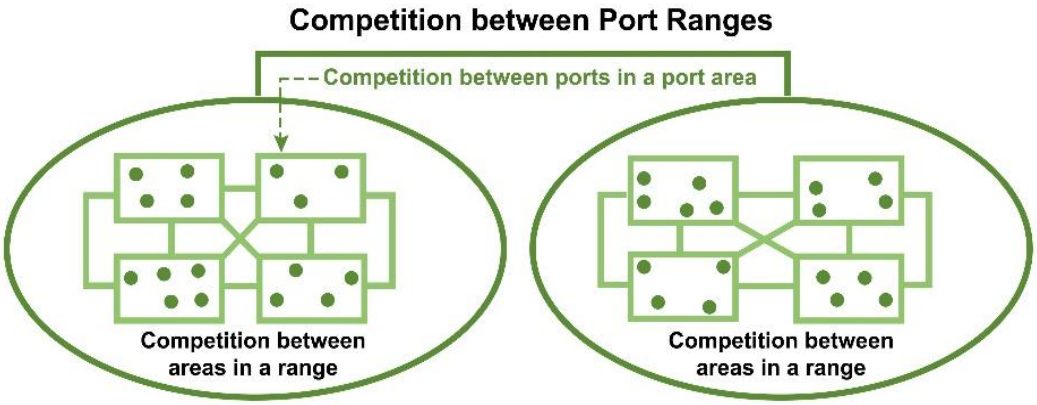

Figure 3.1: Verhoeff's Notion of Port Competition
Source: (Verhoeff, 1981)

Voorde & Winkelman (2002) have also observed that the notion of port competitiveness can have different perspectives owing to the complex nature of it. Therefore, seaport competition can also be understood as a theory wherein there is competition not only between the port but also within the ports. But, this theory is incomplete Voorde & Winkelman (2002) and inappropriate Haezendonck (2001).

Voorde & Winkelman (2002) have presented a viewpoint wherein the notion of port competitiveness should comprise of all factors involved in port competition actually for e.g.: - intervention by government, added value generation, traffic structure of ports, management framework of ports, the competence of port authority, application of the Internet of Things (IoT). Therefore, an alternate notion has been presented by them with regards to the port competition:

> *"Seaport competition illustrates the competition among the port undertakings or the terminal operators with respect to specific transactions (considering origin and destination of traffic flows). The sole aim of the operator is to accomplish maximum growth with regards to goods handling, added value etc. The port competition is influenced by (1) specific customer demands (2) specific production factors (3) supporting and assisting industries connected with each operator and (4) specific competencies of each operator and rival (5) port authorities and public entities."*

From this notion of seaport competition, Voorde & Winkelman (2002) have identified 3 levels of competition which has been depicted in figure 3.2:

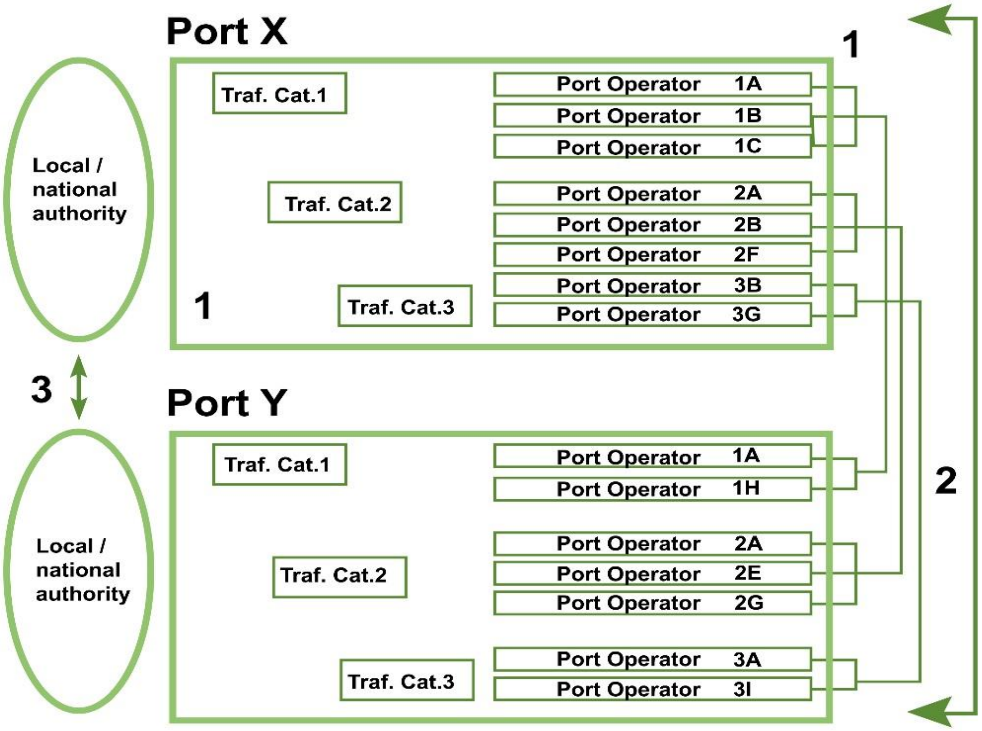

Figure 3.2: Port Competition at three levels
Source: (Van De Voorde & Winkelmans, 2002)

The figure further demonstrates competitions at different levels. Firstly, (1) Among port operators of same port depending upon the category based on the traffic structure of given port. It can be described as Intra-Port Competition at the operator level. Secondly, (2) Among port operators of different ports, in similar traffic category. This type of competition can be observed among the ports in the same range that cater to common hinterlands. It can be described as Inter-Port Competition at the operator level. Thirdly, (3) Among port authorities. It can be described as Inter-Port Competition at port authority level.

Finally, Voorde & Winkelman (2002) states that the actual competition is not between entire ports, but it takes place between the port undertakings and terminal operators.

Haezendonck (2001) also viewed the notion from the same angle for describing port competitiveness however the author had pointed out 4 levels of competition. Goss (1990) and Haezendonck (2001) both emphasis on the significance of the commodity structure of the port while studying port competition. Furthermore, it is important to distinguish between competition between the port authorities and competition between port operators wherein port authority's objective is to improve port performance and port operator's objective is to acquire traffic related to certain traffic category.

Moreover, if observed from the viewpoint of Porter's Theory of comparative advantage of nations related to port industry, it is evident from the study that none of

the ports can be successful in all traffic categories and mostly ports compete intensively in one or two traffic categories.

Therefore, it can be concluded that Haezendonck (2001) and Voorde & Winkelman (2002) have approached the notion of port competition from the same angle regarding the port competitiveness within specific traffic categories among port undertakings. However, the notion presented by Haezendonck (2001) with regards to port competition is:

> *"Port competition objective is to acquire trade in certain traffic categories, which involves actors like port operators are engaged with other supporting actors like port authorities wherein port authorities undertake the task to provide opportunities or impose constraints on the port operators as well as on the entire port cluster."*

From this notion of seaport competition, Haezendonck (2001) has identified 4 levels of competition which has been depicted in figure 3.3:

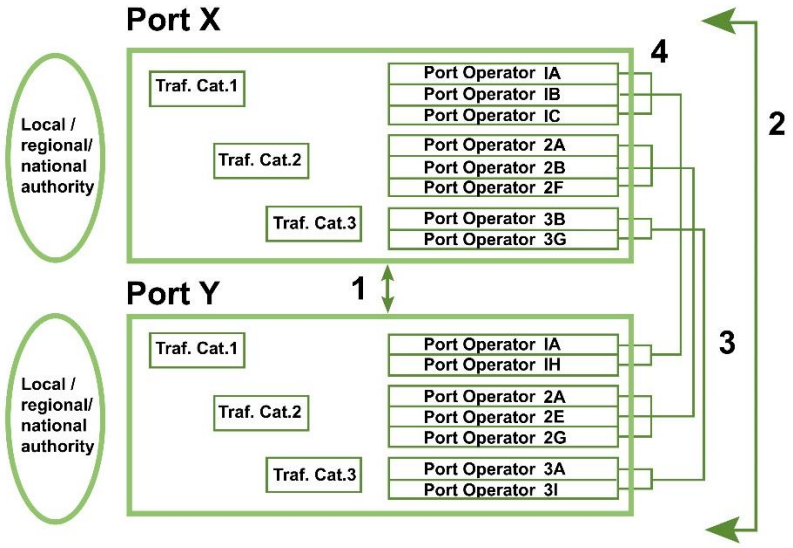

Figure 3.3: Port Competition at four Levels
Source: (Haezendonck, 2001)

The figure 3.3 seems similar to the previous figure 3.2 but has got significant differences like Haezendonck (2001) has explored an extra level of port competition and her analysis adds an extra layer on the study done by Voorde & Winkelman (2002). It further demonstrates competition at four different levels.

Firstly, (1) *Inter-Port competition* at port authority level – The objective of the port authority is to provide necessary infrastructure, to prevent monopoly, to provide optimal working conditions etc. Secondly, (2) *Inter-Port competition* at commodity level – the entities intensively compete against each other for gaining market share or for better positioning in specific traffic category. This aspect was not illustrated in the previous model. Thirdly, (3) *Inter-Port competition* at operator level – limited to

specific traffic categories. Lastly, (4) *Intra-Port cluster competition* – the operators compete within the same port.

The notion of Intra-Terminal competition has been described by World Bank (2000) as the companies competing within the same terminal to provide similar services.

3.1.1 Notion of Inter-Port Competition at the Hinterland Level

The hinterlands of the port being served should overlap for the inter-port competition to take between port authorities or port operators.

McCalla (1999) has presented the notion of hinterlands as the area which is located behind the port and wherein the port sends imports and from where it draws export. This notion illustrates the restrictive/captive nature of the hinterland.

De Langen (2007) has explained the notion of restrictive/captive hinterland as the region behind the port wherein the port possesses considerable competitive advantage due to lower generalised transportation costs. Due to this reason, the exposure of the ports to the competitive forces is very low as it is focused at serving its own restrictive/captive hinterland. These kinds of similar situations exist because of the existence of factors like trade barriers, the absence of technological innovation, primitive transport infrastructure of intermodality (Haralambides, 2002).

The notion of restrictive/captive hinterlands has become obsolete in the recent times with the recent trends and changes as mentioned in the previous chapter. The transformation of hinterlands from captive to contestable has been observed by the port industry. De Langen (2007) has defined contestable hinterland as all those regions where there is no single port with a clear cost advantage over competing ports and as a result, various ports will have a share of the market. These contestable hinterlands are engaged in intense competition wherein not only cost advantage is a major factor but there are other factors like service frequency of port, infrastructure quality and political impact on the port operating environment (Vigarie, 2004). Therefore, the relevance of contestable hinterland is not only limited to port competition but also for inter-port competition with respect to containerized cargo wherein containers are least captive cargo among all the traffic categories (Zondag, 2010).

3.2 Significance of study of Port Competitiveness

The above literature on port competition is significant to this study as it not only gives an illustration of the notion of port competition by various researchers, but it also provides us with an understanding as to why it is important to analyse the competitive position of the ports with respect to the needs of the port operators in the recent years. This can be witnessed in the instance of container terminals and ports as the competition which has been influencing them has boosted over the recent years.

The study of port competitiveness and competition helps the port operators to construct policies and strategies for determining their upcoming competitive position by interpreting the recent competitive standing. It is evident from the observations made in Chapter 2 that port competition contributes significantly at qualitative and

logistics level rather than infrastructural and physical characteristics along with contributing towards strengthening of port competition in overlapping hinterlands. Moreover, the focus has increased on factors that are qualitative in nature and are difficult to quantify and measure rather than focusing on physical infrastructure and costs which can be measured quantitively. Therefore, a detailed assessment of port competitiveness determinants is important in structuring port policy and port strategy. Successful evaluation of vital strengths and weakness of a particular port can contribute towards determining the level of its competitiveness.

According to CNEL (2004), the definition of port competitiveness is the ability or potential of selling and producing, coping with competition, successfully competing within the market and reacting to competitor's strategy. Thus, it can be comprehended that port competition exists in the natural state of the market and competitiveness is associated with how agents of competition act in scenarios which are intensively competitive. Competitiveness not only relates to profit maximization and economic values but also to provide value-added goods and customer service. Non-economic values also play a very important role in securing customer loyalty by providing quality service. Yeng, Huang & Huang (2004) states that port competitiveness comprises of both economic and non-economic variables out of which only some are quantifiable. Therefore, it can be observed from various literatures that port competitiveness is associated not only with quantity but also to quality. Nevertheless, the significance of recognizing the factors for improving the competitiveness of the port should not be overly stressed.

Furthermore, the purpose of this study around port competitiveness also depends on the significance on the components like the decision of ports with regards to decisions of localisations of firms thereafter possible economic effects on the regional level. This is primarily correct as the revolution of logistics happened because the lines and shippers took the initiative to integrate sea leg of transport with inland distribution services and logistics, in which ports play a significant part (Basta & Morchio, 2008).

From the literature discussed previously, thus the study on port competitiveness provides a concept for port operators and port authorities to understand their competitive position and for constructing strategies accordingly. In the next segment, methodologies used previously in various research based on port competitiveness will be illustrated.

3.3 Methodologies Incorporated in Measuring Port Competitiveness

For measuring port competitiveness, distinct methodologies can be used. In existing literatures many methodologies have been used to analyse and measure port competitiveness. The type of method incorporated mainly depends upon the factors like availability of data, the objective of the study being conducted and context within which the study is being performed. But ultimately it depends on the analysis of the study being qualitative or quantitative and scope of the study whether is related to port(s), terminal(s), port range etc. (Basta & Morchio, 2008).

This segment illustrates the overview of 17 different methods and application which have been used in the existing literature for measuring port competitiveness and

competition. This has been categorically illustrated across different sections depending upon their type.

3.3.1 Frequently Used Methods

1. Data Envelopment Analysis (DEA): This methodology was applied by Tongzon (2001) and Barros (2006) and its objective is to study the economic efficiency of ports by assessing “decision units”. The methodology compares relative levels of efficiency of different terminals and ports with respect to the relationship among the output produced and resources employed (Basta & Morchio, 2008).
2. Market Share Analysis (MSA): This methodology was applied by Michalopoulos, Pardalis & Stathopoulou (2007) to estimate port competition and this methodology was described as traditional by the authors. The port(s) being examined were considered to have the degree of competition which was equivalent to market share under study. Therefore, it can be observed that the market share of given port is equal to competitiveness degree in the market being studied. This methodology is straightforward but there is the absence of certain competitive factors which should be included in this methodology.
3. SWOT Analysis: SWOT is an abbreviation for Strength, Weakness, Opportunities and Threats. This methodology was applied by Ircha (2001) and Chou, Chou & Liang (2003) for their research. Ircha (2001) considers this methodology suitable as she conducts her research at a qualitative level taking external opportunities, threats and internal weakness and strengths for Canadian ports. The objective of her study was to deliver entire comprehension of ports’ reactions and role to external and internal changes. This study also contributes towards definition, key issues priority and for the formation of goals, objectives and strategies.
4. Linear Regression Technique: This methodology was applied by Tongzon (2002) and Tongzon & Heng (2005) in their research work. The authors draw out eight determinants related to port competitiveness based on literature. Thereafter, they create a PCI (Port Competitive Index) model and implement it on principal component analysis. Consequently, the Linear Regression Model was also applied in the research. But the objective of the study was to identify port competitiveness determinants and their effects along with effects of private sector participation on the port industry for improving performance and efficiency of ports.

3.3.2 Different Methods associated with Benchmarking Practices

5. Principal Component Analysis: This methodology was applied by Tongzon (1995) for providing a framework for uniform port comparison. In his research, the author used different variables for container ports at a global level. A similar approach was incorporated by Pardalis & Michalopoulos (2008) and the study classified the ports on basis of similarity. According to the viewpoint of the authors, PCA positions the groundwork for Benchmarking.

6. Benchmarking Analysis: This methodology was applied by Michalopoulos, Pardalis & Stathopoulou (2007) for the research on Mediterranean ports and Pardalis & Michalopoulos (2008) for research on Piraeus port. This analysis is built on the basis of the benchmarking technique which aims to improve processes through best practices and continual implementation of optimal practices for obtaining ideal results. This is methodology has an upper hand as compared to other methodologies as the different variables being used are flexible in both quantitative and qualitative way. Therefore, it is easier to deal with complex scenarios while conducting research on terminal and port operations. It also presents a better interpretation of the research which can be analysed by stakeholders. The model accesses the performances of the ports and establishes a leader port for the market being considered in the study. Moreover, it also pinpoints the differences between the port is focused on as compared to average ports and leader ports. This methodology will be elaborated in more detail later in Chapter 4, section 4.2.

3.3.3 Different Methods associated with Port Selection Criteria

7. Simulation: This methodology was applied by Asperen & Dekker (2010) and is based on port selection criteria. This methodology quantifies flexibility in port routing which would aid the concerned authorities in the selection process for ports. It functions as a simulation model that is based on Java programming language. This model includes elements like the location of inventories, parameters for costs, transport networks etc and it also incorporates sensitivity analysis for the rationality of the results obtained from this model. This model mainly focuses on the quantitative explanation of significant port selection criteria like flexibility, charges, shipping frequency and location.
8. Factor Analysis: This methodology was applied by Yeo, Roe & Dinwoodie (2008) for their research work on port competitiveness in China and Korea. This methodology is associated with port selection criteria and it utilizes the exploratory factor analysis instead of confirmatory factor analysis. The authors explore determinants of port competitiveness by incorporating exploratory factor analysis within the interested zone of shipping companies. There are mainly two steps carried out by this method. Firstly, the varimax rotation is utilized for transformation sets of associated variables into sets of non-associated linear combination of same variables. Secondly, subsequently carrying out reliability tests for analysing the accordance of the response from the surveys.
9. Discrete Choice Model: This methodology was applied by Yeo, Roe & Dinwoodie (2008) for their research work and it is also based on port selection criteria as factor analysis. Moreover, Tiwari, Itoh & Doi (2003) and Malchow & Kanafani (2004) incorporated this methodology for modelling transport choice. The conclusions from their study focused on the significance of location, characteristics and port calls of a given port in port selection criteria. De Langen (2007) illustrated in his study on Austrian port competition and contestable hinterland, that this methodology doesn't incorporate the behavioural factors while choosing a port.

3.3.4 Different Methods associated with Multi-Criteria Decision Methods

10. Analytic Hierarchy Process (AHP): This methodology was applied by Huang, Huang, Teng & Wu (2001) and Huang, Teng, Huang & Wu (1999) for their research on port competitiveness and the motivation for the authors to choice this methodology was the capability of the method for capturing the complexity of port environment. There are mainly three steps carried out in this method and it's advantageous as it can aid in measuring tangible and intangible criteria, providing the study with validity. The steps in this method include Firstly, (1) to structure hierarchy related to decision making choices. Secondly, (2) to make the comparison for making priorities. Thirdly, (3) for synthesising priorities to measure different alternatives related to decision making. In this methodology, the empirical factor in the study contains specific variables which act as proxies for the variables which are theoretical.
11. Fuzzy Multi-Criteria Grade Classification Model (FMGC): This methodology was applied by Huang, Huang & Ku (2003) for their study on port competitiveness. This model is an extension of the AHP model. It incorporates factors which are missing in the AHP model thus making it more complex.
12. Grey Relational Analysis (GRA): This methodology was applied by Manzano, Nuno, Laxe, Valpuesta,& Quijada (2009) and Teng, Huang & Huang (2004) for determination of competitiveness for container ports in East Asia. The authors have applied GRA to survey data and statistics for ranking competitive criteria as it is required to manage without insufficient data and variability issues related to tracking port performance data. Moreover, they also incorporated sensitivity analysis for getting conclusive results for accurate identification of criteria's and factors related to the competitive position of ports taken into consideration for study.
13. Promethee Analysis: This methodology was applied by Manzano, Nuno, Laxe, Valpuesta,& Quijada (2009) related to Spanish ports. The authors have illustrated in their research that AHP restraints as the analysis are aggregate and this can lead to loss of important information. Therefore, for their research, they incorporated Promthee Analysis as it also provides the alternative ranking. Along with organising the ranking, it also helps to enabling possible incompatibilities among decision alternatives. The significant advantage of this methodology is the transparency, merger of various aspects of competitiveness into the single value and to overcome subjective judgements.

3.3.5 Different Methods associated to Port Forecasting Models.

14. Logit Models: This methodology has been applied by Veldman & Buckmann (2003) for their study on the Maasvlakte 2 project. These models focus more on forecasting approach and are not merely used for measuring port competitiveness. The authors in their study also illustrated market share and choices regarding routing which can be associated with demand function which can be used in port forecasting.
15. Multinomial Logit Model: This methodology was applied by Zondag, Bucci, Gutzkow & De Jong (2010) and is associated with logit forecasting model.

The author constructed a three-part model for calculating freight flows based on the maritime sector specific scenario, macroeconomic scenario and for calculating the effect of policy measures.

3.3.6 Different Methods associated to Strategic Analysis

16. The Porter's Extended Diamond Framework: This methodology was applied by Haezendonck (2001) and Acosta, Coronado & Cerban (2007) as it not only identifies but also quantifies the determinants of port competitiveness. This model includes factors which affect the competitive position of the port – demand conditions, government intervention, infrastructure, rivalry and factor conditions. The study conducted by Acosta, Coronado & Cerban (2007) also added one an extra factor of chance events/risk factor. This method was initially applied by Rugman & Verbeke (1993) to the port industry and the validity of the results was done using L1 regression analysis.
17. Strategic Positioning Analysis (SPA): This methodology was applied by Haezendonck (2001) for the study on competitive positioning of Antwerp Port on Hamburg-Le Havre Range. This method quantitatively illustrates the performance of ports in terms of market share, diversification and rate of growth. It also provides information on competitive and strategic decision making of ports. The techniques included in this method are Shift Share Analysis (SSA), Port Portfolio Analysis (PPA) and Product Diversification Analysis (PDA). The significant advantage related to this model is the ease of collecting data, trustworthy sources (ports' websites, ESPO, container international). PPA will be explained in detail in the next Chapter 4.

3.4 Significant Determinants associated with Port Competition

Various studies have tried to clarify and list the determinants of port competition. Thus, after reviewing the existing literatures mentioned in previous chapters on port competition, a comprehensive table has been made categorising the determinants in different groups:

Table 3.1: Significant Determinants associated with Port Competition

Maritime (Infrastructure and Superstructure)	Geographical Location; Accessibility; Depth at Berth/Navigation Channel; Entrance/Departure Navigation Aids; Transit Time on Route; Number of Container Terminals; Length of Container Quays; Number/Productivity of Quay Cranes. Storage Capacity; Number of Reefer Plugs;
Service	Vessels Turnaround Time; Vessel Waiting Time; Speed of Cargo Handling; Frequency of Sailings; Quality Management/Policies; Reputation for cargo damage/loss/theft/pilferage; Delays in Cargo Handling/Customs Inspections; Port/Terminal Congestion; Transhipment Capabilities; Bunkering-Fresh Water-Ship's Product Services; Waste Management; Terminal Productivity; Provision of 24/7 Service.
Hinterland	Hinterland Economic Size; Contiguous Cities Economic Size; Land Distance Connectivity; Intermodal Links; Inland Transport Network; Quality of Road/Rail/Barges Connections; Accessibility (inland congestion, reliability); Inland Distribution Networks; Inland Terminals/Logistics Depots; Connectivity with Inland Terminals/Logistics Depots; Provision of Value-Added Logistics Services
Costs	Towage, Pilotage, Mooring Dues; Cargo Handling Charges; Dwell Time Fee; Storage Costs; Terminal Charges and Fees; Bunkering Prices; Waste Processing Dues; Cold Ironing Costs; Inland Distribution Costs.
Labour	Labour Quantity/Productivity; Annual/Daily Operation; Flexibility of Working Hours; Power of Trade Unions; Skills and Professionalism of Labour; Provision of 24/7 Service.
ICT	EDI, Integrated Communication Technologies, Online Documentation/Tracking; Port Users Intranet.
Environment	Environmental Responsibilities; Environmental Standards Implementation; Relationship Port-City; Environmental Compensation Provisions.
Authorities	Government Policies; Government - Local/Regional/National-Intervention; Port Authority Intervention; Management Structure; Private Sector Involvement;
Other	Reputation; Reliability; Preferences of Lines/Shippers; Promotion and Marketing; Customer Relationships; Fast and Efficient Problem Solving; Reporting;

Source: (Scaramelli, 2010)

After having observed the following table illustrating determinants of port competitiveness, two main conclusions can be drawn. Firstly (1), more significance has been given to components like service quality, flexibility and reliability as compared to infrastructure (De Martino & Morvillo, 2008). Cost element is one of the important factors while choosing the port/terminal but not the deciding factor. Secondly (2), the applicability of the determinants mentioned in the above-given table depends from port to port and also is dependent on the relevance of elements in the context of analysis of given port.

3.5 Chapter Conclusion

The focal point of this chapter was port competition and the first section illustrate various definitions of port competition. It was emphasised that due to the complex nature of the port industry, a homogenous definition of port competition doesn't exist. Thereafter, the significance of research on port competitiveness has also been illustrated along with the enumeration of methodologies accessible to measure port competitiveness used by the maritime industry. Finally, the chapter illustrates the determinants of port competitiveness after reviewing various literatures.

This chapter provides a conclusion for the theoretical part of the thesis. In Chapter 2, trends which have been influencing port competition have been discussed and in Chapter 3, the notion and issues of port competition have been examined. The methodology incorporated in this research will be discussed in detail in the next chapter.

Chapter 4 – Research Methodology

After the analysis of existing literature on port competition, in this chapter, the methodology and the methods incorporated for answering the research questions will be presented in detail. The methodology can be defined as an idea or approach in accordance to which the research should be conducted. Whereas, the method can be defined as a technique or procedure that can be incorporated to compile data and examine it. Therefore, in this chapter, it is significant to explain the method and methodology which will be incorporated into this research and thereafter in the subsequent chapter 5 results obtained from this chapter will be analysed. Firstly, (1) Port Portfolio Analysis (PPA) and Benchmarking Analysis (BA) models will be explored in detail. Secondly, (2) survey questionnaire will be explored in detail. Moreover, the reasons for incorporating these techniques as compared to other techniques will also be discussed individually while explaining both the analyses. The two quantitative models will provide answers to the second research question and the questionnaire will support the answers obtained from research questions.

4.1 Port Portfolio Analysis ("Growth-Share Matrix")

Portfolio analysis is a matrix of the Boston Consulting Group (BCG Matrix). This approach was considered for the present study as it has made fundamental changes in the development of strategies to diversify many companies. This matrix was proposed for the research areas of distribution of resources among the various strategic areas of the business to a diversified enterprise. Bruce Henderson believed that the successful development of the company is possible only in the presence of a diversified portfolio which are characterized by different rates of growth in sales and market shares (Henderson, 2008).

As seen in Chapter 3, PPA is incorporated in Strategic Positioning Analysis (SPA) if applied within the scope of the port industry. Strategic Positioning Analysis was applied by Haezendonck & Winkelmans (2002) in their research work. In 1968, the Boston Consulting Group came up with a matrix known as "Growth-Share Matrix" which was extensively used for making strategic plans in building businesses. Port Portfolio Analysis is a function of the growth-share matrix when used within the scope of the port industry. The growth-share matrix presents a platform for experts to analyse and position the business units in ports/traffic categories with respect to two variables. These two variables are market share and average growth rate. The aim of this study is to establish the status of a business unit with respect to its competitors in terms of port or traffic category Haezendonck (2001) and Haezendonck & Winkelmans (2002). In their research, the authors have specified and related the traffic categories of different ports to Strategic Traffic Units and this is similar to the strategic plans in building businesses by Boston Consulting Group.

The BCG matrix recognises four distinctive market position and it has been illustrated in figure 4.1:

Figure 12: Boston Consulting Group Matrix

Growth Rate			
	High	Question Marks	Stars
	Low	Dogs	Cash Cows
		Low	High
		Relative Market Share	

Figure 4.1: Boston Consulting Group Matrix
Source: (Haezendonck, 2001)

There are four main categories in the BCG matrix which comprises of the question mark, stars, dogs and cash cows. The question mark represents low market share and high growth rate. It signifies that the ability to grow is great but there is a need for investment for their growth in market share. Stars represent a high growth rate and high market share. It signifies those business units which are highly successful in business. Dogs represent a low growth rate and low market share. It signifies those business units which are the worst performers. Cash cows represent low growth share but have a large market share. It signifies that the business units have established their presence in the market which is one of the important elements for revenue generation.

These categories in BCG matrix doesn't fit well when incorporated into the port industry and therefore Haezendonck (2001) has amended this approach and has been illustrated in figure 4.2:

GROWTH RATE			
	HIGH	HIGH POTENTIAL	STAR PERFORMER
	LOW	MINOR PERFORMER	MATURE LEADER
		LOW	HIGH
		RELATIVE MARKET SHARE	

Figure 4.2: Adaption of BCG Matrix specifically for Port Industry
Source: (Haezendonck, 2001)

The above approach has also been incorporated into this research as well. High Potential Units represents a high growth rate and low market share and if the

functioning of the units grows consistently it can convert itself to Star Performer. Star Performer represents a high growth rate and high market share. But according to Haezendonck (2001), the units don't hold a competitive sustained advantage. Minor Performer represents a low growth rate and low market share. It signifies that these business units perform worse as compared to other business units. Lastly, Mature Leaders represents a low growth rate and high market share. In the latter part of this research, we analyse the different ports on the basis of this matrix and position them according to total traffic, categorisation of containerised traffic and share of containerised traffic with respect to each ports' total traffic.

4.1.1 Research Data for Port Portfolio Analysis

In this research, we apply Port Portfolio Analysis to the Port of Hamburg. For this research to have conclusive results it is very important to choose ports within a range of ports. This research focuses on especially one important category of the maritime industry i.e. containerised traffic. The reasons and benchmarks which have been taken into consideration for selecting the ports in the range for this research are: -

1. The port must be geographically located in the Hamburg-Le Havre range. This is because the Port of Hamburg's competitive position must be compared to other major ports located in this range. Thus, Hamburg-Le Havre range is significant in terms of the relevance of geographic area being focused.
2. The port taken into consideration should be able to serve Northern and Central Europe by transhipment, inland transport or directly.
3. The port must be recognised for its prominent role in the container traffic category therefore only biggest ports have been considered in Hamburg- Le Havre range. For e.g.: - Amsterdam has not been considered as the container traffic category portrays only a small fraction of the total traffic structure. Moreover, the Port of Amsterdam lacks the capability to compete with Hamburg for containerised cargo segment.
4. The availability of data has also been taken into consideration for selecting the ports. In this research, 10 years of the data have been taken into consideration for getting conclusive results.

Therefore, after having considered the above-mentioned factors, 4 ports were shortlisted and those are Bremerhaven, Rotterdam, Antwerp, Le-Havre as seen in figure 4.3.

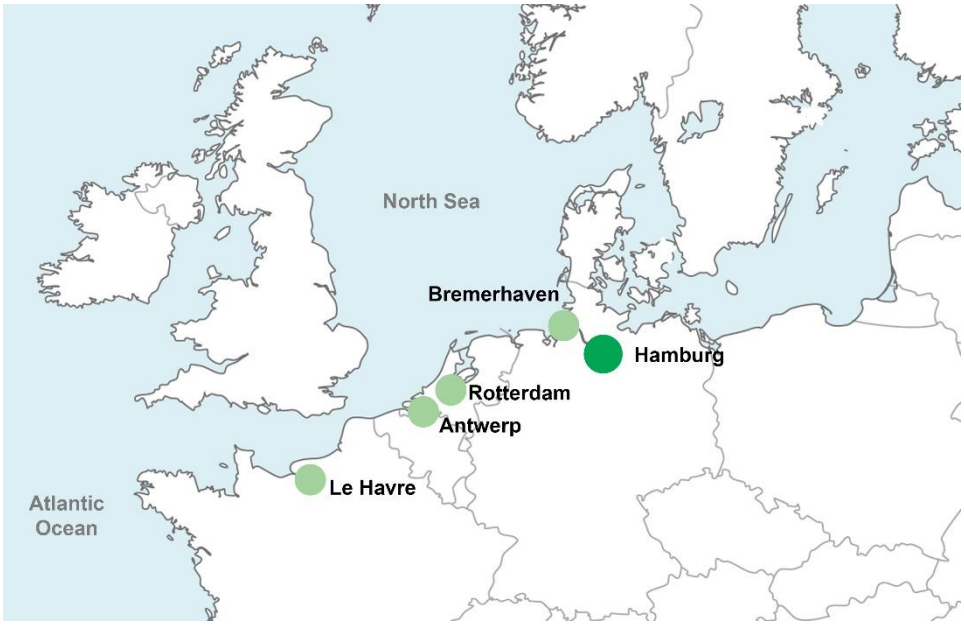

Figure 4.3: Ports Taken into Consideration
Source: (Hamburg Port Authority, 2012)

The ports which have been highlighted in the map have been chosen carefully for carrying out research and applying Port Portfolio Analysis technique. The data related to traffic for conducting the analysis was found mainly through European Seaport Organisation (ESPO) or commonly referred to as Eurostat.

4.1.2 Nominal tons vs Value tons

The traffic data which has been collected from Eurostat which has been utilized for the study is nominal tons. Haezendonck's (2001) research also considered nominal tons while incorporating it in traditional portfolio analysis. The author states that it doesn't consider the significance of the value-addition by other traffic categories. Moreover, the author also introduced the notion of "value tons" and expresses that the cargoes generating high revenues and having high economic values are more significant for port operators.

The author herself has created weighing rules like the "Rotterdam Rule" and "Bremen Rule" and has weighted nominal tons according to these weighing rules. These weighing rules take into consideration the added value by traffic categories which compose the overall traffic structure of port. The data and statistics were collected from the container cargo handling operators. As the added value of one-ton cargo is different for different ports, therefore, the rules are distinctive with regards to each port for which it was created. The limitations which have been listed in the research (Haezendonck, 2001) while creating a distinctive weighing rule for each port are (1) Firstly, lack of accessibility to information (2) Secondly, aggregation of information by non-homogeneous methods (3) Thirdly, process of information collection and analysis having limited transparency.

Due to these limitations, weighing rule was not created for Hamburg port and therefore, the analysis will be incorporated using nominal tons. This limitation is of

acute significance and has been recognised by the author of this research, but it can be incorporated in the future by the researchers pursuing the similar topic.

4.1.3 Port Portfolio Analysis Level 1

- **Port Portfolio Analysis 1** Objective- Position the selected individual ports by evaluating them corresponding to their total traffic

In the first level of PPA, the objective is to position the selected individual ports' by evaluating them corresponding to their total traffic and the portfolio includes the 5 ports being analysed i.e. Hamburg, Le-Havre, Rotterdam, Antwerp and Bremerhaven. Similar to the BCG matrix the PPA also has market share on the x-axis (horizontal axis) and growth rate on the y-axis (vertical axis). Thus, the overall graph has illustrated in four quadrants. The ports have been positioned according to the data in these four quadrants. The x-axis represents the average market share of ports and y-axis represents the average growth rate in Hamburg-Le Havre range.

4.1.4 Port Portfolio Analysis Level 2

- **Port Portfolio Analysis 2** Objective -Evaluating individual ports independently and individual ports' being part of the total traffic category portfolio.

In the second level of PPA, the objective is to evaluate each port independently wherein each port being part of total traffic category portfolio. For conducting this research, the traffic categories which have been chosen are liquid bulk, dry bulk and containerised cargo. For evaluating the categories in terms of their strengths and weaknesses, they have been placed/positioned in the accordance to average growth rate and their share in total traffic structure.

4.1.5 Port Portfolio Analysis Level 3

- **Port Portfolio Analysis 3** Objective - Evaluate individual ports on specific traffic category (Containerized cargo)

In the third level of PPA, a specific traffic category (containerised cargo) focusing on the main purpose of research. Again, the portfolio including the 5 ports being analysed i.e. Hamburg, Le-Havre, Rotterdam, Antwerp and Bremerhaven are considered. For evaluating and classifying the ports in the portfolio, they have been positioned in accordance to the average growth rate and market share with regards to containerised cargo traffic category.

4.1.6 Port Portfolio Analysis Level 4

- **Port Portfolio Analysis 4** - Individual ports are denoted by area on the graph which is proportional to the total traffic.

In the final level of PPA, individual ports are denoted by area on the graph which is proportional to the total traffic and can be considered as a significant addition to this research. The x-axis (horizontal axis) represents the average annual growth rate with regards to containerised cargo and y-axis (vertical axis) represents the average share in total traffic and also the growth rate. The sphere represents the proportional

area for individual ports and the percentage has also been illustrated within the sphere. According to the study performed by Haezendonck (2001), level 4 PPA is significant in following ways: - (1) Firstly, it represents the growth rate of containerised cargo for all individual ports. (2) Secondly, comparing the proportion of containerised cargo of an individual port to other ports. (3) Thirdly, placing/positioning individual port with respect to other ports in Hamburg- Le Havre range.

The evaluation and results of Port Portfolio Analysis have been illustrated in Chapter 5.

4.2 Benchmarking Analysis

Benchmarking technique was incorporated in this research as is the process of identifying, understanding and adapting existing practices of the effective operation of the ports in order to improve its performance by two processes: evaluation and comparison. In the process of benchmarking the best port is determined where similar processes carry out. The results of the studied processes are compared with own results and processes of a company which makes a benchmarking (Voevodina, Gulagina, Loginova, & Tolberg, 2009). In this way, it is possible to learn how the business processes explain why these companies or firms are successful. The goal is to learn from other sectors which according to certain criteria perform better. Due to the fast developing of European Union countries and its respective port, the benchmarking of the ports gains an increasing importance.

In this section, benchmarking analysis will be explored in detail. Benchmarking analysis is a comparatively new method for estimating port competition and it combines both quantitative and qualitative variables as we have already reviewed in previous chapters. The quantitative variables are specified by “Features” (FE) and qualitative variables are specified by “Quality Criteria” (QC). Pardalis & Michalopoulos (2008) have explained in their research that by utilizing benchmarking method we can evaluate the port performance with the help of calculations. The evaluation and measurements which can be achieved using benchmarking analysis are: - (1) Firstly, Benchmarking score for average Hamburg - Havre (HH) port in Hamburg-Le Havre (FE and QC) is calculated (4) Secondly, analyses of Benchmarking scores for all variables for individual ports in Hamburg-Le Havre (FE and QC). Furthermore, after having calculated and analysing the best score (FE and QC) of all ports, a leader port is recognised on the basis of the results. Thirdly, (3) Degree of Competition for individual ports in Hamburg-Le Havre is done. Ultimately, the validity of the analysis is carried out by examining the correlation between the competitive degree and benchmarking scores of ports in Hamburg-Le Havre range.

4.2.1 Research Data for Benchmarking Analysis

The information and data for benchmarking analysis include Hamburg, Bremerhaven, Rotterdam, Antwerp and Le-Havre. The data were obtained from different sources depending upon the type of data. Traffic data was collected on Eurostat website, qualitative data was obtained through container terminal and port authority website. In some cases, port authorities and terminal operators were contacted via phone or email. Estimations have also been made in the case of limitation of data.

4.2.2 Benchmarking Analysis Variables

The variables have been incorporated by analysing previous literatures on port competitiveness. Overall, thirty variables have been recognised and they have been categorised as feature criteria and quality criteria. Furthermore, these variables are sub-categorised. Sub-categories of feature criteria are labour, demand and supply. These variables are quantitative variables. Sub-categories of quality criteria are ship application, cargo application, miscellaneous, information systems and others. These variables are qualitative variables. These categorisations of variables have been done by reviewing the research of (Michalopoulos, Pardalis, & C., 2007). The categorisation has been analysed and tabulated as follows in figure 4.1:

Table 4.1: Variables which are considered for Evaluation

Category	Sub-Category	Variables	Kind	Measure Unit
FE	Supply	No. of Container Terminals	Quantitative	Number
FE	Supply	No. of Berths	Quantitative	Number
FE	Supply	Total Length of Berths	Quantitative	Meters
FE	Supply	No. of Cranes	Quantitative	Number
FE	Supply	Surface of Cont. Terminals	Quantitative	1000 m2
FE	Supply	Storage Capacity	Quantitative	TEU
FE	Supply	Reefer Points	Quantitative	Number
FE	Supply	Depth	Quantitative	Meters
FE	Demand	Total Cont. Traffic	Quantitative	1000 TEU
FE	Labour	Annual Operation	Quantitative	Days
FE	Labour	Daily Operation	Quantitative	Hours
QC	Others	Rail Facilities	Quantitative	Yes/No
QC	Others	Logistics Centre	Quantitative	Yes/No
	Others	Expansion Project	Quantitative	Yes/No
	Info Systems	EDI Operation	Quantitative	Yes/No
QC	Info Systems	Integrated Info Management	Quantitative	Yes/No
QC	Appl.to ships	Ship Handling	Quantitative	Yes/No
QC	Appl.to ships	Vessel Planning	Quantitative	Yes/No
QC	Appl.to ships	Yard System	Quantitative	Yes/No
QC	Appl.to ships	Cargo Manifests	Quantitative	Yes/No
QC	Appl.to ships	Loading/Discharge	Quantitative	Yes/No
QC	Appl.to ships	Container Control	Quantitative	Yes/No
QC	Appl.to ships	Cargo Control	Quantitative	Yes/No
QC	Appl.to ships	Gate Control	Quantitative	Yes/No
QC	Appl.to ships	Stacking	Quantitative	Yes/No
QC	Appl.to ships	Tracking	Quantitative	Yes/No
QC	Miscellaneous	Advertisement	Quantitative	Yes/No
QC	Miscellaneous	Statistics	Quantitative	Yes/No
QC	Miscellaneous	Reporting	Quantitative	Yes/No

Source: (Pardalis & Michalopoulos, 2008)

4.2.3 Benchmarking Analysis Statistics

The statistics which has been used as the foundations of this methodology for identifying leader port are: -

- Benchmarking Score of Feature (FE) ($BSCORE_{(FE)}$) and Benchmarking Score of Quality Criteria (QC) ($BSCORE_{(QC)}$):

$$BSCORE_{(FEp)} = AVERAGE\ (var_1, var_2...var_n)$$

$$BSCORE(_{QCp}) = AVERAGE\ (var_1, var_2...var_m)$$

The total number (N) denotes the number of features (FE)-11 and the total number (M) denotes the number of quality criteria (QC)-19.

Therefore, by evaluating them together:

$$BSCORE(_{FEp+QCp}) = BSCORE_{(FEp)} + BSCORE_{(QCp)}$$

- Benchmarking Score (BSCORE), that is used to compute the score for the "Average Hamburg-Le Havre port"

$$BestSCORE = Max(\underset{P=n}{\overset{P=1}{\text{Price}_i}})$$

P= 1, 2..., p is the number of ports, all variables are prices, and i= 1, 2, ...k is the number of variables considered (30).

- Best Score (BSCORE), which will be utilized to verify the best scores being registered:

$$BSCORE = Average\ (\underset{P=n}{\overset{P=1}{\text{Price}_i}})$$

P= 1, 2..., p is the number of ports, all variables are prices, and i= 1, 2, ...k is the number of variables considered (30).

- Port competitiveness degree (PCD) will be computed through $BENCH_p$:

$$BENCH_p = AVERAGE\ (BSCORE_{(FEp)}, BSCORE_{(QCp)})$$

$BENCH_p$ denotes average of benchmarking scores for characteristics and value criteria for five ports being considered for the analysis.

- The Competitiveness degree (CD) for each port denoted by:

$$CDp = \frac{100BENCHp}{\sum_{p=1}^{n} BENCHp}$$

Using the above-mentioned statistical formulas results are computed and graphs are plotted and illustrated in the next chapter. The validation of the model is done

through correlation utilizing the Excel software and thereafter evaluation of average Hamburg-Havre port compared to leader port is possible once the model has been validated. Thus, outcomes of benchmarking analysis combined with port portfolio analysis have been the foundations of developing the questionnaire. This questionnaire was distributed to maritime professionals and specialists to evaluate determinants of port competitiveness in Port of Hamburg.

4.3 Survey

The survey is a process of data collection through an instrument called as questionnaires. Surveys were conducted to add more value to the study by gathering information from stakeholder and to capture their thoughts, opinions, and feelings and develop decisions making based on analysed results. Though the Benchmarking analysis and Port Portfolio Analysis gave an insight about the port competitiveness in Port of Hamburg, it is equally important to analyse and interpret the opinion of the main stakeholders which will add more knowledge to the study as well as help to evaluate the key determinants of port competitiveness in Port of Hamburg.

4.3.1 Questionnaire

The questionnaire involved asking stakeholders to respond to a set of oral or written questions. The questionnaire was self-built and has a standard list of questions constructed in a specific sequence and it was distributed to the maritime professionals and postgraduate candidates pursuing maritime studies. The respondents were sent a link to the Google survey form via e-mail for completing the survey. The Google survey form was used as it is the most convenient and reliable method of conducting surveys without the doubt about the results being hampered. In some cases, respondents were also contacted directly through the phone. The questionnaire had closed-ended questions incorporating the following determinants. In all there were 15 questions addressing 15 determinants derived from various literatures (Van Der Sluijs, 2007); (Cullinane & Khanna, 2000); (Parola, Risitano, Ferretti, & Panetti, 2017); (Kim & Lu, 2016).

The Ordinal Scale was used to rate the questions in which the numbers are assigned to the objects to determine the relative extent to which certain characteristic is possessed by the Port of Hamburg. 5-point rating scales were selected where Excellent represents 5 points, Above Average represents 4, Average is 3, Below Average is 2 and Very Poor is 1. These rating scales help in identifying that whether the determinants understudy for the Port of Hamburg has more or less of the characteristics as compared to other competitors.

Table 4.2: Determinants selected for Evaluation

	Determinants
GL	Geographical location
MC	Maritime /foreland connections.
PI	Physical infrastructure
QS	Range and quality of services offered
CP	Customs clearance procedures
CI	Delays in cargo inspections
BC	Barge connectivity
RC	Road transport connectivity
RAIL	Rail transport connectivity
PM	Port management and administration
EM	Environmental management policy
PLAN	Port of Hamburg 2025 Plan
RP	Relationship port and city
INFO	Information platform
OVERALL	Overall Rating

Source: Elaboration of Author

4.3.2 Respondents

To check the validity of the questionnaire and to increase the value of the data collection, pretesting of the questionnaire was carried before administering the survey to potential respondents. This was done through cognitive interviewing of 4 potential study participants. They were debriefed, then shown the questionnaire and time taken to complete the questionnaire was recorded. Their feedback on the clarity of the questionnaire, suitability to the participants and the possible obstacle that could arise was taken into consideration. The questionnaire was revised after analysing their response. Demographic information and open-ended question were removed.

The questionnaire was circulated by email to 100 respondents and the respondents were selected on the basis of their affiliation to the maritime industry. In some cases, respondents were contacted directly via phone. The response rate was 50 %. The contact information was obtained mostly through websites. Respondents include experts and professionals from port authorities (HPA-2), ship owner (MPC Capital-3), consultants (DNV GL-15), ship agents, the terminal operator (Eurogate-3 and HHLA-2) and postgraduate candidates (MEL students 25). The response rate can be considered moderate because of the reasons like lesser than expected turnout rate of respondents even after their willingness to participate, the reluctance of respondents for participation and being vacation season, some professionals were out of office. These kinds of limitations exist while conducting internet-based surveys

and these have been the main factors and the limitations of conducting a survey for this research.

4.3.3 Research Analysis of Survey

The response rate of the survey was sufficient enough to proceed for descriptive analysis. Moreover, these results are can be utilized to validate the results obtained from the benchmarking and port portfolio analysis.

The collected data was checked for its completeness, edited, coded, tabulated, grouped and organized according to the requirement of the study and then entered into Excel for analysis. The Cronbach's Alpha test was run to estimate the reliability of questionnaire items. Descriptive Statistics such as mean, standard deviation, frequencies were used to summarize and describe the basic features of data. Pearson Correlation test was used to measure the strength of a correlation between variables.

4.4 Chapter Conclusion

In this chapter, the research methodologies that have been incorporated for answering the research questions have been illustrated. In-detail elaboration was presented with regards to benchmarking analysis and port portfolio analysis along with the information and data required to be incorporated into both these analyses. Lastly, the notion behind questionnaire was elaborated in detail along with the respondent's type. Limitations have also been stated in this chapter and evaluation of the research can be found in the next chapter 5.

Chapter 5 – Results

After having discussed the methodology in the previous chapter, in this chapter the outcomes of quantitative and qualitative models are examined and evaluated. The evaluation will be done on the basis of the graphs which have been demonstrated in this section. The data used to formulate the graphs can be found in the Appendix section. Firstly, (1) The competitive position of Hamburg is compared with the competing ports in Hamburg – Le Havre range by using the results of the Port Portfolio Analysis. Secondly, (2) Using the pre-determined criteria's the competitive position of the ports is evaluated using the results of Benchmarking analysis. Thirdly, (3) the outcome of the survey is analysed regarding the determinants of the Port of Hamburg on the stakeholder perspective.

5.1 Results of Port Portfolio Analysis

The Port Portfolio Analysis (PPA) has been incorporated on four different levels for the five ports (Hamburg, Rotterdam, Antwerp, Le Havre, Bremerhaven) being considered. Firstly, (1) the port position is illustrated with respect to the total traffic. Secondly, (2) Traffic structure of each port is evaluated to identify the key traffic category. Thirdly, (3) the port position is illustrated with respect to container traffic category. Lastly, (4) the port position is illustrated involving container traffic with respect to total traffic.

5.1.1 Port Portfolio Analysis Level 1

The outcomes generated from Port Portfolio Analysis Level 1 have been illustrated below in figure 5.1.

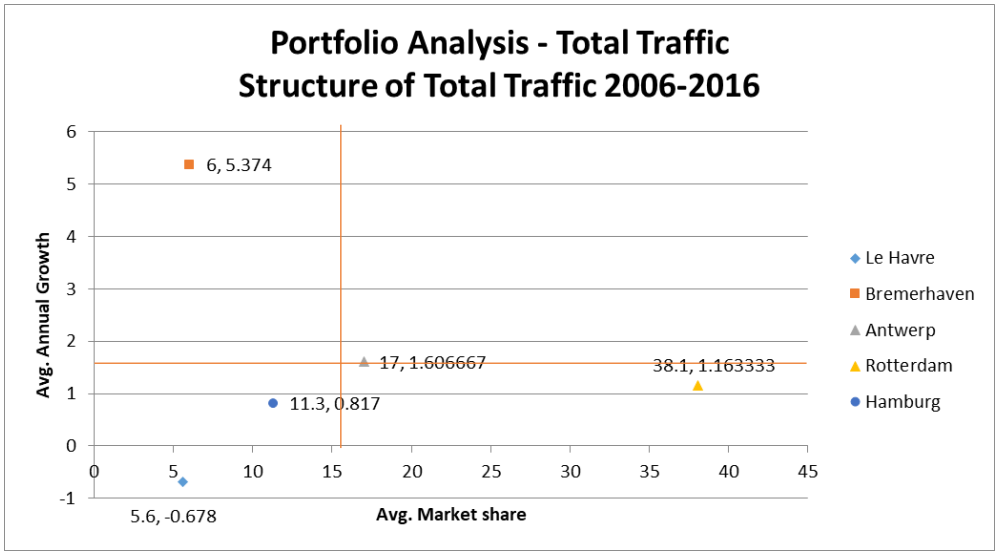

Figure 5.1: Portfolio Analysis – Total Traffic
Source: Generated by Author on Excel

The above graph illustrates the evaluation of five ports with respect to their average market share on the x-axis and average annual growth on the y-axis. This outcome has been formulated using the data collected in the period 2006-2016. The orange vertical line shows the average market share of ports for the period 2006-2016. The orange horizontal line shows the average annual growth of ports for the similar period. Therefore, four quadrants are created by division created by these two lines and analysis can be conducted on basis of it. According to the data, the average market share sums up to 15.6% whereas the average annual growth sums up to 1.65%. The annual average growth rate of all major ports has been significantly been lowered due to the financial crisis of 2008.

Thus, it can be inferred that Rotterdam is the only port which can be exhibited as a “Mature Leader”. Moreover, Rotterdam also has the highest market share among other ports which is 38.1%. Le Havre showcased a growth of -0.678% and the corresponding market share of 5.6%. Hamburg showcased a growth of 0.81% and the corresponding market share of 11.3%. Therefore, Le Havre and Hamburg can be exhibited as “Minor Performer” port. Antwerp is the port with the second largest market share of 17% and average market share of 1.60%. It is the only port which can be exhibited as “Star Performer” port and has a stable growth rate too. Bremerhaven is the only port that can be exhibited as “Highest Potential” port. It has an average market share of 6% and average annual growth of 5.37%.

5.1.2 Port Portfolio Analysis Level 2

The Port Portfolio Analysis level 2 considers the traffic structure category of each port. Three traffic categories have been considered which are container, liquid bulk and dry bulk. These three traffic categories comprise of almost 100 % of the total traffic categories of the ports being considered. The proportion of each category in total traffic is illustrated on the x-axis and their relevant growth rate on the y-axis. The objective of PPA level 2 evaluation positions all the traffic categories for each port for understanding their comparative significance.

5.1.2.1 Port of Hamburg

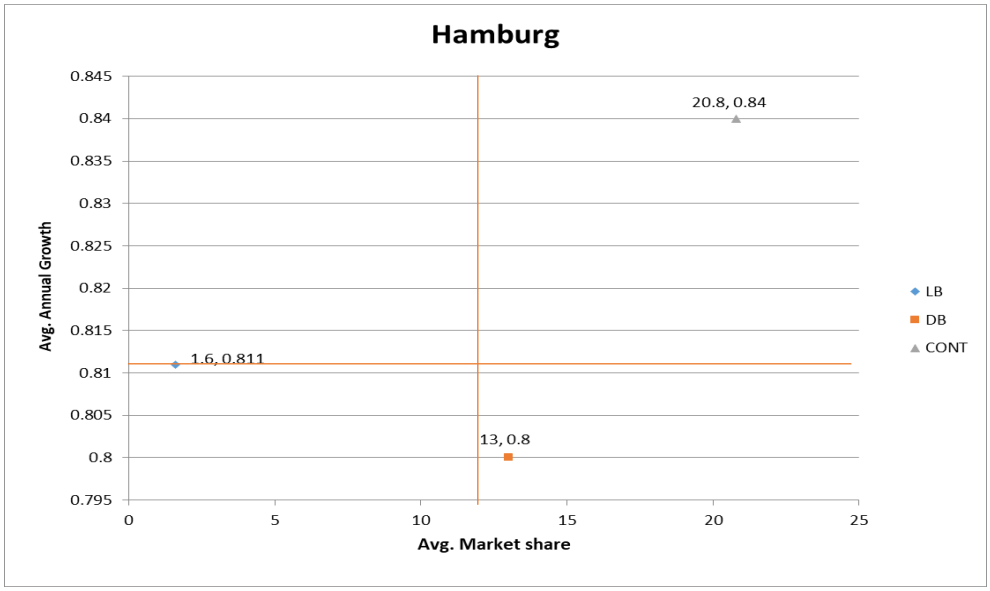

Figure 5.2: Traffic Structure of Port of Hamburg
Source: Generated by Author on Excel

The traffic structure of Port of Hamburg is illustrated in the above Figure 5.2.
Thus, it can be inferred that the traffic category of container segment is the “Star Performer” and has 20.8% the average market share and the average growth of 0.84% which is higher than average growth rate. It is noteworthy that the growth rate of the container segment in 2008-2009 was -28% and was the most affected traffic category among the others. The Dry Bulk segment can be exhibited as “Mature Leader” and the Liquid bulk segment can be exhibited as “Minor Performer”. If the annual growth rate of Liquid Bulk increases by a margin it can become “High Potential” category. The Dry Bulk segment was the least affected in the 2008-2009 financial crisis (-2.9%). But in the present scenario, none of the traffic categories can be exhibited in “High Potential” category.

5.1.2.2. Port of Rotterdam

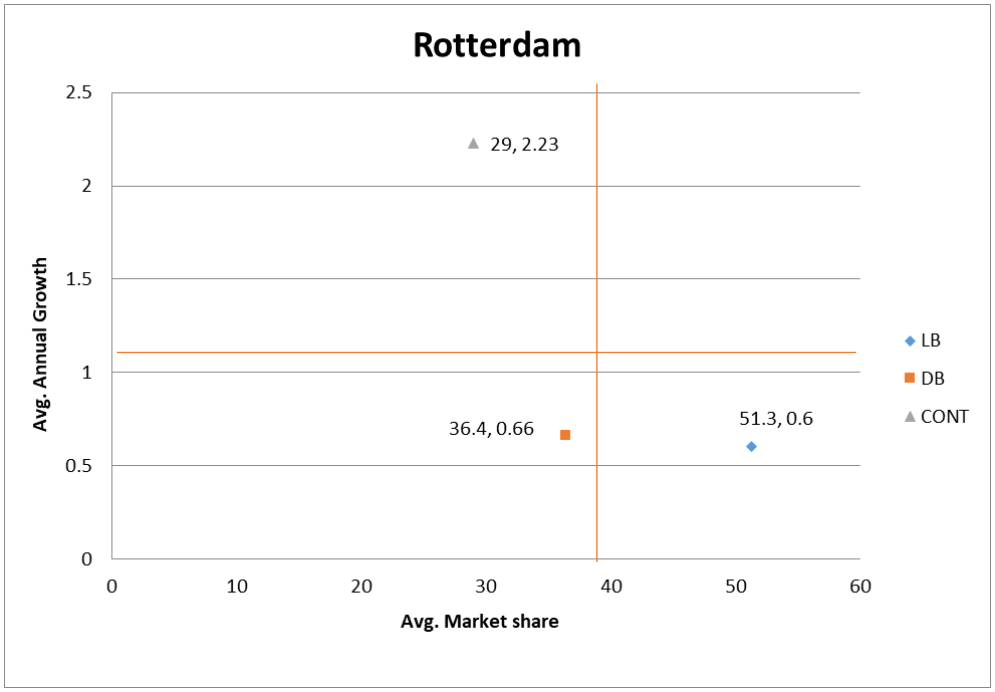

Figure 5.3: Traffic Structure of Port of Rotterdam
Source: Generated by Author on Excel

The traffic structure of Port of Rotterdam is illustrated in the above Figure 5.3. Thus, it can be inferred that, in the case of Rotterdam, none of the traffic categories can be exhibited as “Star Performer”. Container segment can be exhibited as a “High Potential” unit with an average market share of 29% and average annual growth of 2.23% which is way above the total average. It is remarkable to note that the growth rate of the container segment in 2008-2009 was -9.9% and was the most affected traffic category among the others. The Liquid bulk can be exhibited as “Mature Leader” with a significant share of 51% but the average annual growth is less than the total average. Liquid bulk segment was the least affected in the 2008-2009 financial crisis (1.7%). Dry bulk can be exhibited as “Minor Performer” with the average market share of 36.4% and average annual growth 0.66%. Moreover, this average annual growth is also less than the total average.

5.1.2.3 Port of Bremerhaven

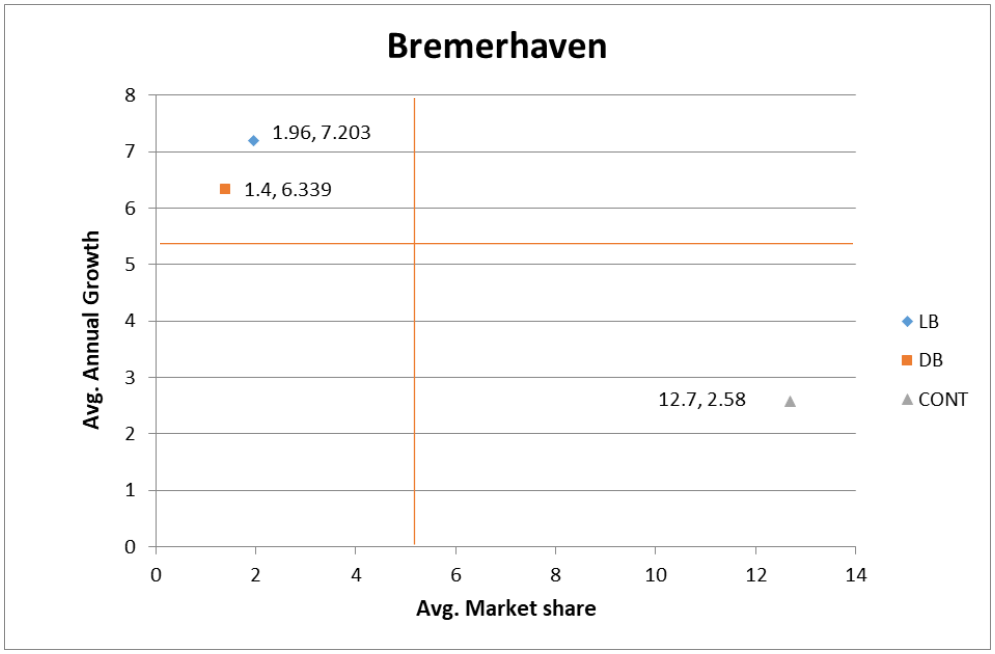

Figure 5.4: Traffic Structure of Port of Bremerhaven
Source: Generated by Author on Excel

The traffic structure of Port of Bremerhaven is illustrated in the above Figure 5.4. Thus, it can be inferred that, in the case of Bremerhaven, none of the traffic categories could be exhibited as “Star Performer” and “Minor Performer”. But the container segment can be exhibited as “Mature Leader” with the average annual growth of 2.58% and average market share of 12.7%. It is notable that the growth rate of the liquid bulk segment in 2008-2009 was -44.03% and was the most affected traffic category among the others. Dry bulk together with liquid bulk can be exhibited as “High Potential” unit with the average growth rate of both categories more than the total average. The dry bulk segment was the least affected in the 2008-2009 financial crisis (27.59%).

5.1.2.4. Port of Le Havre

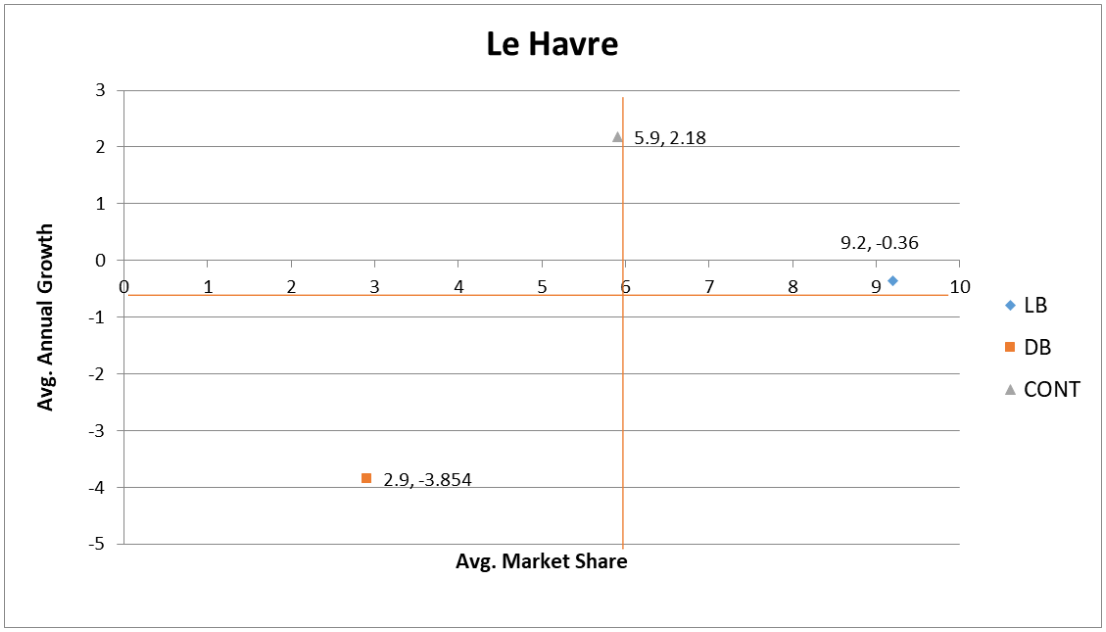

Figure 5.5: Traffic Structure of Port of Le Havre
Source: Generated by Author on Excel

The traffic structure of Port of Le Havre is illustrated in the above Figure 5.5.
Thus, it can be inferred that container segment can be exhibited as “High Potential” unit with an average annual growth of 2.18% and a market share of 5.9%. But, this traffic category can become Star performer with a marginal increase of 0.1% in market share. Moreover, the average annual growth of this category is more than the total average. Dry bulk can be exhibited as the “Minor Performer” and this was the segment which was drastically affected the most in 2008-2009 (-16.58%). Liquid bulk can be exhibited as “Star Performer” and was the least affected segment in 2008-2009 crisis (-2.9%). None of the categories could be positioned in “Mature Leader” segment.

5.1.2.5 Port of Antwerp

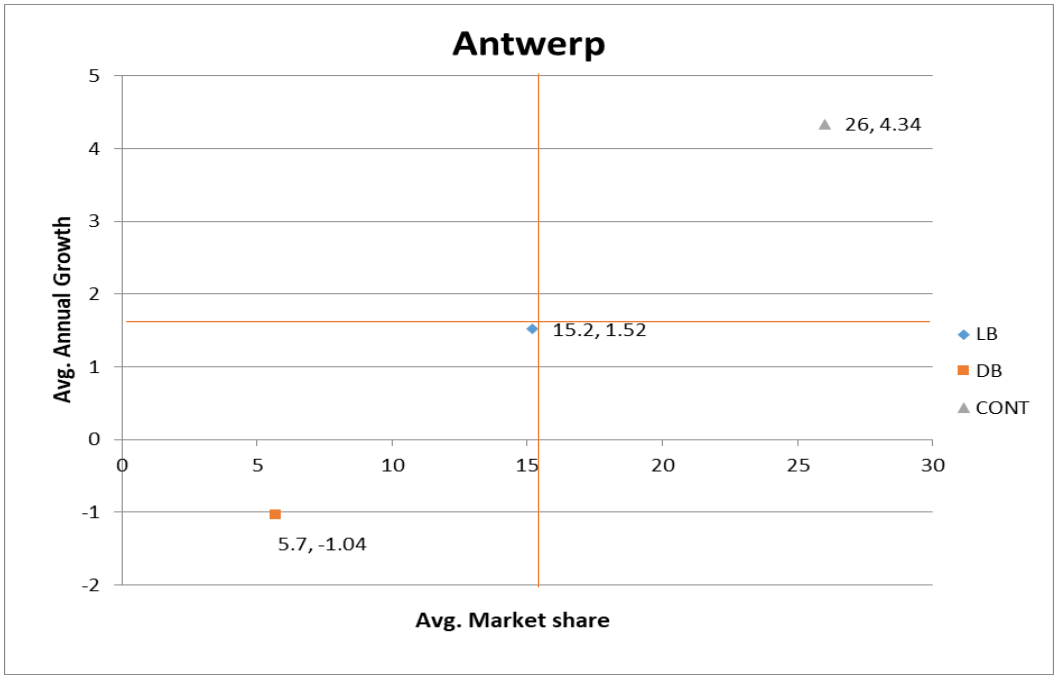

Figure 5.6: Traffic Structure of Port of Antwerp
Source: Generated by Author on Excel

The traffic structure of Port of Le Havre is illustrated in the above Figure 5.6.
Thus, it can be inferred that the container segment is indeed the “Star Performer” with the average market share of 26% and average annual growth of 4.36% which is way higher than the total average. Moreover, the container segment was the worst affected in the period of 2008-2009 (-16.3%). It is remarkable that Port of Antwerp has shown such a sustainable growth in this segment. Liquid bulk can be exhibited as “Minor Performer” and it was the segment which was least affected in the period of 2008-2009 (0.5%). Dry Bulk can also be exhibited as “Minor Performer” and none of the traffic categories can be positioned as “Mature Leader” and “High Potential” units.

5.1.3 Port Portfolio Analysis Level 3

The Port Portfolio Analysis level 3 considers specific segment i.e. container and evaluates the outcomes with respect to the 5 ports taken into consideration for this research. The Port Portfolio Analysis level 2 exhibits that almost 3 ports can be categorised as “Star Performer” in the container segment. Furthermore, the research also concentrates on container traffic category.

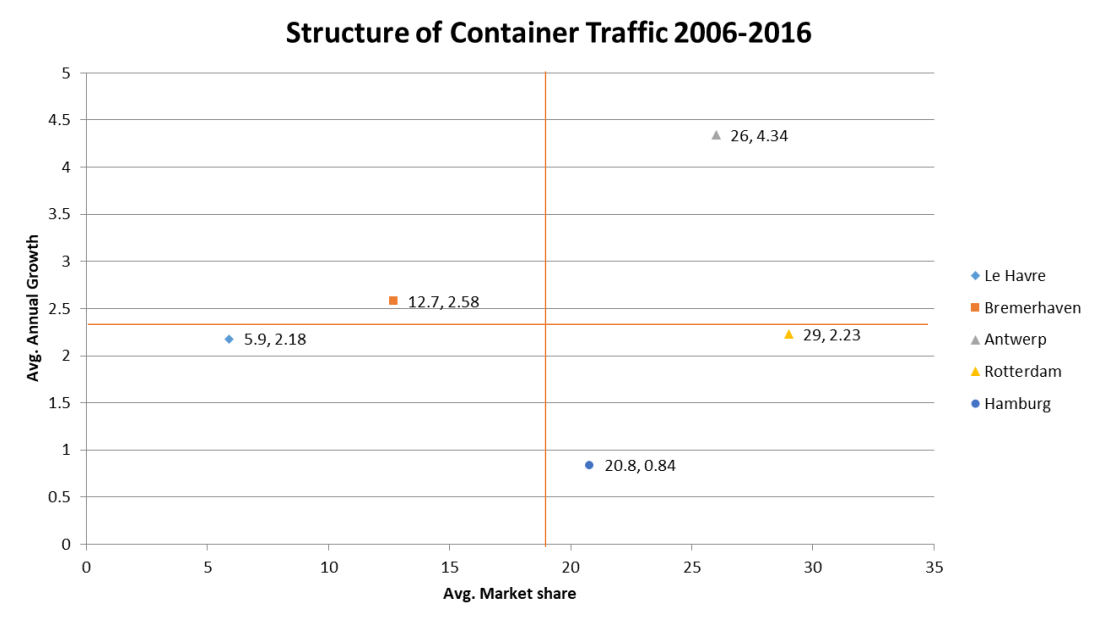

Figure 5.7: Traffic Structure of five ports (2006-2016)
Source: Generated by Author on Excel

Taking into consideration the five ports, the average annual growth is on the y-axis and average market share is on the x-axis. Thus, by positioning the ports based on the container segment we can explore and evaluate the port competitiveness and the above figure shows the outcome for the same. The orange vertical line shows the average market share of ports for the period 2006-2016 (2.34%). The orange horizontal line shows the average annual growth of ports for the similar period (18.88%).

Thus, it can be inferred that Antwerp can be exhibited as a “Star Performer’ with an average annual growth of 4.34% and average market share of 26%. Rotterdam can be exhibited as “Mature Leader” and can become the Star Performer with the marginal increase in the annual growth rate. Hamburg can also be exhibited as “Mature Leader” and its positioning is very low with respect to the average annual growth rate and is not, therefore, able to position itself better. Moreover, it has lost it 2nd position as leading container port to Antwerp in 2015 and the 2008-2009 global financial crisis was one of the significant reasons behind it. Also, Bremerhaven can be exhibited as “High Potential” port and Le Havre can be exhibited as “Minor Performer”.

5.1.4 Port Portfolio Analysis Level 4

Haezendonck (2001) states in her research that Port Portfolio Analysis Level 4 can be regarded as the most significant level among all as it evaluates the element of total traffic. The y-axis represents the average annual growth and the x-axis represents average share in port traffic. But the circular shape reflects the area relative to the total traffic of the given port. There are 3 benefits to this final level of evaluation. Firstly, (1) It illustrates the relevance of container segment relative to the overall commodity structure of port. Secondly, (2) It illustrates the proportion of the container segments for each port for easy comparison between the ports. Finally, (3) it also illustrates the growth rate of the container segment for all the ports taken into consideration.

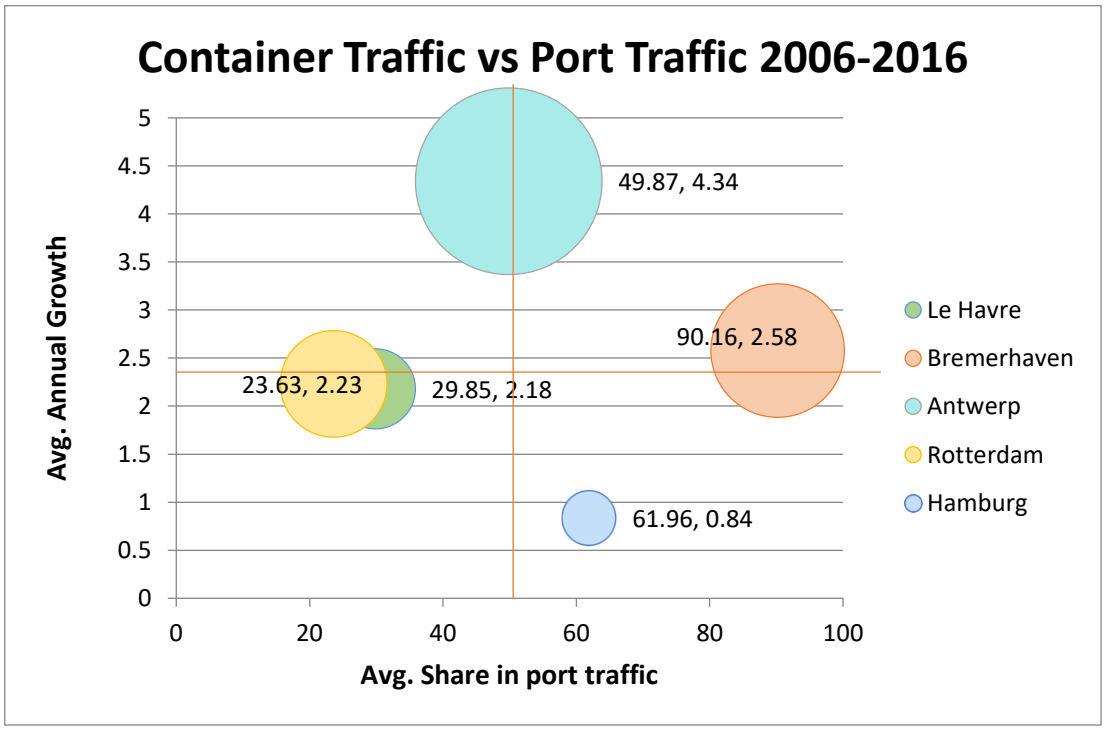

Figure 5.8: Total Port Traffic vs Container Traffic for five ports, 2006-2016
Source: Generated by Author on Excel

From this graph, it can be inferred that Bremerhaven is the “Star Performer” as it performs exceptionally in terms of container traffic relative to its overall port traffic and none of the ports is close to it (90.16%). This shows the focus area for Bremerhaven. This is also very risky because when container volumes drop, the whole port cluster will be affected. Therefore, it would not necessarily see the large share of containers as a good thing. Hamburg comes next to Bremerhaven at 61.96% but the lower growth rate has led to the port being exhibited as “Mature Leader”. Antwerp can be exhibited as “High potential” due to the of 49.87% of its container traffic relative to its overall port traffic. Moreover, the growth rate of Antwerp is also very high at 4.34%. It can be anticipated that with the current trend, Antwerp will be the “Star Performer” in the future. Le Havre can be exhibited as “Minor Performer” due to the low container traffic to its overall port traffic (29.15%).

It is noteworthy that Rotterdam is also exhibited as “Minor Performer” even though it is almost the “Star Performer” in Level 3 and is also the Leading container port of Europe will the largest market share of 38.1%. It is because the container traffic relative to its overall port traffic is only 23.63%. This reflects the fact that Rotterdam has pioneered itself as a port in the container segment and equally focuses on the segments as well.

5.1.5 Partial Conclusions

From the above evaluation through Port Portfolio Analysis we can conclude that the Firstly, (1) Port of Hamburg is “Minor Performer” in level 1 in terms of total traffic. Secondly, (2) Port of Hamburg considers container segment to be the most significant category with relation to the total traffic and is a “Star Performer”. Thirdly, (3) Port of Hamburg is a “Mature Leader” in level 3 in the terms of container traffic as compared to the other 4 ports. Finally, (4) Port of Hamburg is a “Mature Leader” in level 4 as well in the terms of container traffic relative to its overall port traffic.

Thus, it can be concluded that Hamburg has serious competition with Rotterdam and Antwerp, but Bremerhaven is a potential competitor too in the future as it completely is focusing on container segment and the geographical location of Bremerhaven is far more attractive than Hamburg. Le Havre due to its low growth rate and low market share can’t be considered as a potential competitor in the future.

5.2 Results of Benchmarking Analysis

By using the Port Portfolio Analysis, the position of five ports taken into consideration was evaluated. By incorporating the benchmarking method and evaluating the outcome we can recognise the elements which influence the competitive position. Also, by analysing the Port Competitiveness Degree (PCD), we can also establish the port having the leadership position for the year 2016. The outcomes of the benchmarking analysis have been illustrated with the help of graphs.

5.2.1 Benchmarking of Ports relative to the Average Port

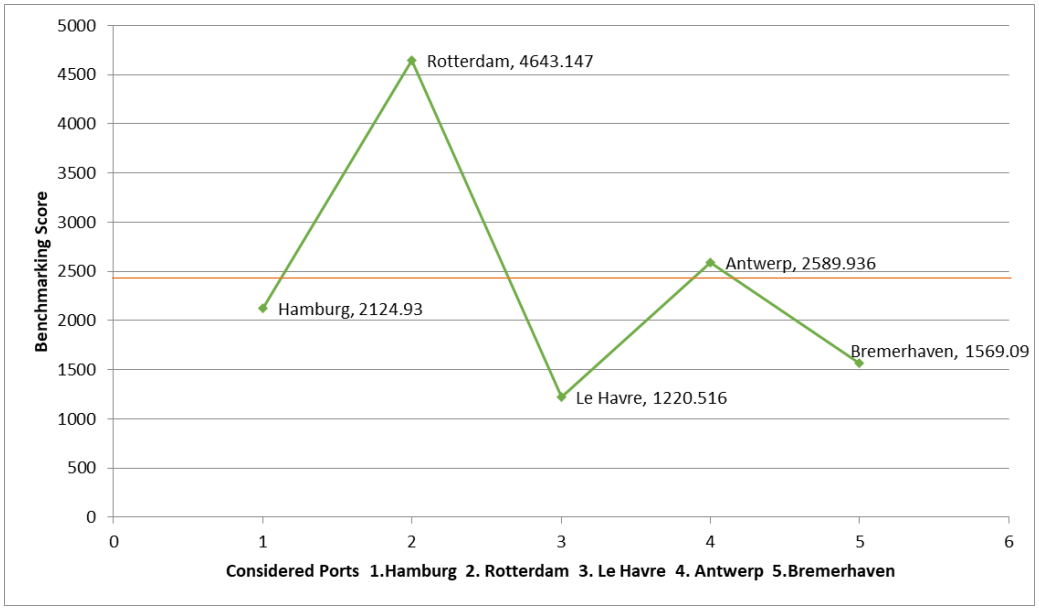

Figure 5.9: Benchmarking of Ports relative to the Average Port
Source: Generated by Author on Excel

Firstly, the comparison is done among the 5 ports taken into consideration with the average port in Hamburg – Le Havre Range. The objective is to determine and establish a leader port on the basis of the scoring system. By calculating the average benchmark scores of all ports on the basis of criteria and features we have obtained the benchmarking score for the average port in Hamburg – Le Havre range.

Rotterdam's performance was exceptional scoring 4163.47. Second in line is Antwerp with a score of 2589.93 and third is Hamburg with a score of 2124.93. Bremerhaven scored 1559.09 and Le Havre scored 1220.5. The score for the average port is 2429.52. Thus, it can be observed that Rotterdam and Antwerp are the only two ports above the scoring of the average port. It is noteworthy that since Rotterdam has scored exceptionally, it has raised the score of average port significantly. Hamburg, Bremerhaven and Le Havre's total score are below the score of the average port.

5.2.2 Benchmarking: Features and Quality Criteria

The overall benchmarking scores needs to be analysed along with the detailed analysis of the scores on the basis of feature and quality criteria as well.

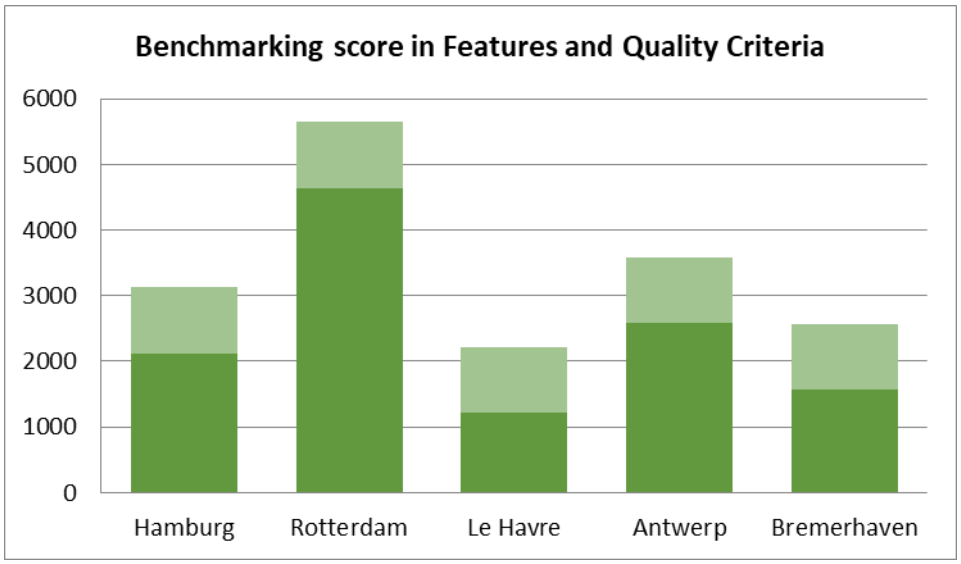

Figure 5.10: Benchmarking of Ports consisting of Features and Criteria
Source: Generated by Author on Excel

The dark green shade represents the feature criteria and the light green shade represents the quality criteria. Rotterdam performs the best considering both feature and quality criteria followed by Antwerp, Hamburg, Bremerhaven and Le Havre. Being the leading ports of Europe, the five ports all have secured almost the same score for the services provided to shipping lines.

5.2.3 The Port Competitiveness Degree Index

By calculating using the formula provided in the methodology section for BENCHp, Port Competitiveness Degree Index is obtained and graphically illustrated.

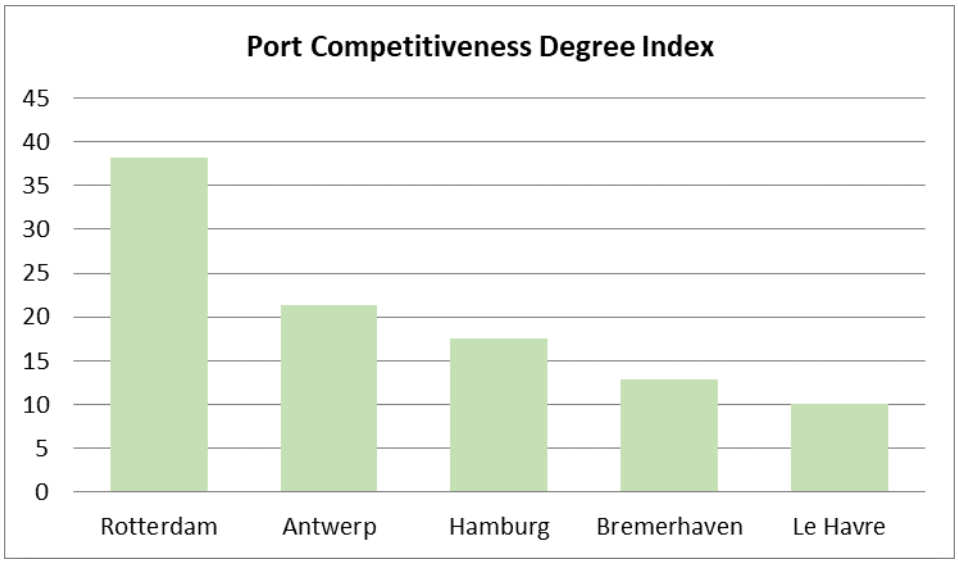

Figure 5.11: Port Competitiveness Degree Index
Source: Generated by Author on Excel

It can be inferred from the graph that Rotterdam has scored the most with 38.22% followed by Antwerp with 21.32%, Hamburg 17.49%, Bremerhaven 12.91% and Le Havre 10.04%. Thus, Rotterdam can be exhibited as a leader port and finally can be validated with a correlation test on excel.

5.2.4 Benchmarking Score and Port Competitiveness Degree Correlation

For validation of the previously performed analysis, we implement a correlation between Benchmarking score and Port Competitiveness Degree and thus, a connection can be established between the two.

The outcome of the correlation run on the excel is 0.989 hence proving the validity of the model as there is a relationship between the Benchmarking score and Port Competitiveness Degree.

5.2.5 Comparison of Feature and Quality Criteria

Since the correlation has been performed it can be inferred that there is a relationship between the Benchmarking score and Port Competitiveness Degree and thus validation has been carried out. Therefore, we can evaluate which factors provide a competitive edge to Rotterdam and Antwerp when compared with Hamburg. The scores obtained by Hamburg are compared with the average port score in the Hamburg – Le Havre range.

Table 5.1: Benchmarking Score Data

	Hamburg	Rotterdam	Le Havre	Antwerp	Bremerhaven	Average
No of Container Terminals	4	9	15	5	3	7.2
No of Berths	22	23	26	24	14	21.8
Total length of berth (m)	6590	16575	7193	8665	4930	8790.6
No of Cranes	81	105	53	74	40	70.6
Surface of Container Terminal (Million sq. m)	4.3	8.47	4.16	5.36	2.9	5.038
Reefer Points	5220	17628	2034	6835	4792	7301.8
Depth	15	24	16	16	15	17.2
Number in thousand TEU, (2016)	8929	11,675	2480	9891	5510	7697
Labour Days	360	360	360	360	360	360
Daily Operation	24	24	24	24	24	24
	2124.93	4643.147	1220.51	2589.93	1569.09	2429.52

Source: Port Authority and Terminal Operator Websites

It can be inferred that Hamburg scores less than the average port in some of the variables and the overall score are also less. But, Hamburg's score is quite close to Antwerp and the average port. Moreover, Rotterdam has a maximum depth of 24 meters whereas Hamburg's depth is less than the average port. Depth has a significant value as compared to the other variable as it reflects the port accessibility by large vessels. Nonetheless, Hamburg is preparing itself for accommodating 20000 TEU vessel by the end of 2018. It is noteworthy that high scores are also allotted to port handling a greater number of TEU. Moreover, the length of the berth is also be observed as Rotterdam has almost double the length as compared to the port following up. Whereas it has a smaller number of berths as compared to the other three ports. In the labour category, not much difference can be encountered as the ports being the leading container ports of Europe operate almost round the year and 24 hours per day.

5.3 Conclusions on the Quantitative models

The objective of Port Portfolio Analysis was positioning the five ports being evaluated with respect to the container segment. Thus, after performing the analysis it can be concluded that Hamburg is a "Mature Leader" in the Hamburg – Le Havre region. Moreover, another quantitative analysis i.e. the Benchmarking analysis was also performed to establish the leader port in the container segment and also analysing the variables which have contributed to this establishment. The outcome of the benchmarking analysis illustrates that again Hamburg is number 3rd and is behind Rotterdam and Antwerp.

Furthermore, it is noteworthy that Hamburg doesn't score more than the average port in Hamburg – Le Havre range. Lastly, for evaluating the determinants of the port competitiveness, a survey is conducted based on a questionnaire for understating stakeholder perspective.

5.4 Results of Survey

5.4.1 Part One: The Respondents

The data from the stakeholders were collected by self-administered questionnaires. The number of potential respondents was found to be moderate in number. Respondents were politely approached to fill in the questionnaire. Once completed, the respondent returned the questionnaire to the researcher. The surveys were distributed to 100 potential respondents and the actual response rate was found to be 50% with each and very questioned answered. Most of the remaining potential respondent did not complete the survey while other did not respond to the invitation the survey. All the respondents have expressed the wish to stay anonymous and did not declare their demographic information. The sample size was fair enough to proceed for descriptive analysis.

5.4.2. Part Two: Stakeholders perception towards Port of Hamburg's competitive position

The survey was carried out for recognising the essential port competitiveness determinants in the case of Port of Hamburg. The collected data was preliminary checked for its completeness. The collected data was edited, coded, tabulated, grouped and organized according to the requirement of the study and then entered into MS Excel for analysis. The Cronbach's Alpha test was run to estimate the reliability of questionnaire items, descriptive statistics were used to describe the basic features of the data in a study along with summaries about the sample and the measures. Together with simple graphics analysis, they form the basis of virtually every quantitative analysis of data. Descriptive Statistics such as mean, standard deviation, frequencies were used to summarize and describe the basic features of data. Pearson Product-Moment Correlation test was used to measure the strength of a linear correlation between variables.

Analysis and Interpretation of Data

A) Reliability Test: Cronbach's Alpha for Internal Consistency:

The questionnaire was self-generated by the researcher, so reliability was an important concern as to how well the test measures what it should. Cronbach's alpha is a considered to be a measure of scale reliability measure of internal consistency, that is, how closely related a set of items are as a group. Cronbach's alpha coefficient was run to measure the reliability of the all the questionnaire items.

Cronbach's Alpha Formula

The formula for Cronbach's alpha is:

$$\alpha = \frac{N \cdot \bar{c}}{\bar{v} + (N - 1) \cdot \bar{c}}$$

Where:

- N = the number of items.
- $\bar{c}$ = average covariance between item-pairs.
- $\bar{v}$ = average variance.

Cronbach's alpha ranges between 0 and 1. The closer Cronbach's alpha coefficient is to 1 the greater the internal consistency of items in the scale. To determine the reliability of each group of items, George and Mallery (2003) developed the following rules of thumb: > 0.90 = Excellent, 0.80 - 0.89 = Good, 0.70 - 0.79 = Acceptable, 0.60 - 0.69 = Questionable, 0.50 - 0.59 = Poor and < 0.50 = Unacceptable. The value of the alpha coefficient was 0.70 respectively, suggesting that the items have a good internal consistency. Hence, it can be concluded that the questionnaire is reliable (George & Mallery, 2008)

B) Descriptive Analysis:

Table 5.2 shows the descriptive statistics of the 15-determinant considered to analyse the perception of stakeholder towards the Port of Hamburg competitive positioning. The descriptive statistics describes the basic features of the data in a meaningful way. Mean score is the average of a data set whereas standard deviation is the dispersion of a set of data from its mean. The determinant "Information Platform" scored the highest mean with a score of 4.68 then was "Rail Transport Connectivity" scored the second highest which is equal to 4.48 followed by third highest scorer "Port Management and Administration" with a score of 4.44. "The range and quality of services offered" and "customs clearance" also had scores of 4.22 and 4.38 respectively. These determinants are perceived as above average in comparison to the competitors. The determinants namely "geographical location'', "physical infrastructure", "delays in cargo inspections" "port management and administration" and "environmental management policy" are perceived to be average in comparison to the competitors. The barge connectivity score was 2.43 and was perceived below average and therefore scored the least among all determinants. This result is further validated from the statistics provided at Port of Hamburg website which shows only 2% of barge connectivity contribution to container hinterland traffic as compared to 56.6% by road and 41.4% by rail (Hamburg Port Authority, 2018).

The overall perception of the stakeholders towards all the determinants was average as the mean score is 3.8, the mode is 3.73 and the standard deviation is 0.5.

Table 5.2: Descriptive Statistics

Questions	Determinants	Mean	Mode	Standard Deviation	Standard Error
Q1	GL	3.42	3	0.5	0.1
Q2	MC	4.1	4	0.5	0.1
Q3	PI	3.04	3	0.3	0
Q4	QS	4.22	4	0.5	0.1
Q5	CP	4.38	5	0.7	0.1
Q6	CI	3.2	3	0.5	0.1
Q7	BC	2.43	2	0.5	0.1
Q8	RC	4.4	4	0.5	0.1
Q9	RAIL	4.48	4	0.5	0.1
Q10	PM	4.44	4	0.5	0.1
Q11	EM	3.64	4	0.5	0.1
Q12	PLAN	3.56	4	0.5	0.1
Q13	RP	3.6	4	0.5	0.1
Q14	INFO	4.68	5	0.5	0.1
Q15	OVERALL	3.44	3	0.5	0.1

Source: Generated by Author on Excel

Table 5.3: Abbreviations of Determinants

GL	Geographical Location
MC	Maritime / Foreland connections.
PI	Physical Infrastructure
QS	Range and Quality of Services Offered
CP	Customs Clearance Procedures
CI	Delays in Cargo Inspections
BC	Barge Connectivity
RC	Road Transport Connectivity
RAIL	Rail Transport Connectivity
PM	Port Management and Administration
EM	Environmental Management Policy
PLAN	Port of Hamburg 2025 Plan
RP	Relationship Port/City
INFO	Information Platform
OVERALL	Overall Determinants

Source: Elaboration of Author

Table 5.4: Average Perception Score of Stakeholders

Perception score of stakeholders			
Mean	Mode	Standard Error	Standard deviation
3.8	3.73	0.09	0.5

Source: Generated by Author on Excel

The total mean perception score of stakeholders towards Port of Hamburg with respect to its competitive positioning was 3.8 which is considered to be average in comparison to its competitor.

C) Correlation:

The correlation was run to determine the relationship between each determinant and the overall perception of the Port of Hamburg in terms of its competitive positioning. The closer the number is to 1 the stronger the relationship. A plus sign means a positive correlation while a minus sign means a negative correlation. The value for high correlation, ranging from 0.5 to 1.0 or –0.5 to –1.0. The medium correlation ranges from 0.3 to 0.5 or –0.3 to –0.5 and low correlation range from 0.1 to 0.3 or –0.1 to –0.3.

The determinants maritime/foreland connections, physical infrastructure, range and quality of services offered, customs clearance procedures, barge connectivity, Port of Hamburg 2025 Plan and relationship port/city are having negative correlation with overall perception of stakeholder while delays in cargo inspections, road transport connectivity, rail transport connectivity, port management and administration, environmental management policy and information platform are having positive correlation with the overall perception of stakeholder. There exists correlation among Geographical Location, Environmental Management Policy, Rail Transport Connectivity followed by Custom Clearance Procedure, Barge Connectivity and Physical Infrastructure to the Overall determinants.

	GL	MC	PI	QS	CP	CI	BC	RC	RAIL	PM	EM	PLAN	RP	INFO	OVERALL
GL	1														
MC	0.079584	1													
PI	-0.09892	-0.1522	1												
QS	0.111485	-0.18272	-0.05099	1											
CP	0.062625	0.271119	-0.24306	0.109952	1										
CI	0.148888	9.03E-17	-0.40339	0.146501	-0.1732	1									
BC	-0.01959	-0.10551	0.131145	-0.22812	-0.14407	-0.11514	1								
RC	0.199107	0.247436	-0.19772	-0.03014	0.194709	0.231455	0.091372	1							
RAIL	0.399056	0.227128	-0.11169	-0.10216	0.053376	-0.14709	-0.12581	-0.12105	1						
PM	-0.01959	-0.10551	0.014051	-0.22812	-0.14407	0.13159	-0.05519	-0.06091	-0.12581	1					
EM	0.384959	0.072739	-0.155	-0.25253	-0.07323	0.136083	0.077225	-0.06299	0.303576	0.161165	1				
PLAN	0.019592	-0.07034	-0.01405	0.067474	0.205119	-0.29608	-0.02597	-0.01523	-0.11613	0.055195	-0.41298	1			
RP	-0.13234	0.356348	-0.14237	0.032556	0.408248	-0.16667	-0.01645	0.308607	0.049029	0.065795	0.068041	0.098693	1		
INFO	-0.02432	0.056136	0.079745	0.044448	-0.18969	0.105021	-0.16929	0.03241	-0.02746	0.003455	0.021437	-0.60807	-0.21004	1	
OVERALL	0.551846	-0.01758	-0.10304	-0.06747	-0.14407	0.049346	-0.13636	0.015229	0.358072	0.025974	0.412984	-0.18831	-0.01645	0.089828	1

Figure 5.12: Correlation Table between the Determinants
Source: Generated in Excel by Author

Table 5.5: Abbreviations of Determinants

GL	Geographical Location
MC	Maritime / Foreland connections.
PI	Physical Infrastructure
QS	Range and Quality of Services Offered
CP	Customs Clearance Procedures
CI	Delays in Cargo Inspections
BC	Barge Connectivity
RC	Road Transport Connectivity
RAIL	Rail Transport Connectivity
PM	Port Management and Administration
EM	Environmental Management Policy
PLAN	Port of Hamburg 2025 Plan
RP	Relationship Port/City
INFO	Information Platform
OVERALL	Overall Determinants

Source: Elaboration of Author

5.4.4. Conclusions of Survey

It is feasible to recognise the determinants of port competition using the perception of stakeholders in the case of the Port of Hamburg. Port of Hamburg's 7 determinants information platform, port management and administration, rail and road transport connectivity, quality of services, custom clearance and maritime connection have scored a mean more than 4. Therefore, these determinates boost the port competitiveness of Hamburg. On the other hand, the rest of the 8 determinants have scored less than a mean of 4 and the least has been scored by barge connectivity which undermines the port competitiveness of Hamburg in this case. Moreover, by performing correlation on the determinants it has been observed that correlation does exist among Geographical Location, Environmental Management Policy, Rail Transport Connectivity followed by Custom Clearance Procedure, Barge Connectivity and Physical Infrastructure to the Overall determinants.

5.5 Chapter Conclusion

In this chapter, we have used Port Portfolio Analysis, Benchmarking Analysis and Survey for analysing the competitiveness of Hamburg along with the determinants. From Port Portfolio Analysis it was concluded that Hamburg can be positioned as a “Mature Leader” in containerised traffic. Benchmarking analysis was performed for inspecting the variables utilized to determine competitive standing. Thus, it was concluded that Port of Hamburg was behind Rotterdam and Antwerp based on the outcomes of Port Competitive Index (PCI) in Hamburg – Le Havre range. From the survey, the perspective of stakeholders regarding the determinants was analysed and it was concluded that Hamburg needs to substantially improve its barge connectivity services to uplift port competitiveness.

In the next Chapter, research questions will be answered, and research will be concluded along with limitation and suggestions.

Chapter 6 – Conclusion

In this chapter, we conclude the entire research. In Chapter 1, a brief introduction was presented about the research topic, research impetus, characteristics of Port of Hamburg and the port development plan 2025. Moreover, the objective of the research was also illustrated along with the research questions and research limitations. Finally, the structure of research was also elaborated.

In Chapter 2, the developments influencing the port industry and port competition have been illustrated and evaluated. This chapter is important as it is significant to recognise and comprehend these macro environmental factors influencing the port industry.

In Chapter 3, the different notions of port competition are presented and after reviewing various literatures it has been concluded that a universal viewpoint does not exist regarding a single notion of port competition. This chapter also provides the reasoning as to what is the significance of port competition. Moreover, methodologies which have been incorporated in the previous decades have been described in brief and lastly, the chapter is concluded with the table containing determinants of port competition.

In Chapter 4, the methodology incorporated for the research was described in detail. The Port Portfolio Analysis and the Benchmarking Analysis were part of the quantitative analysis and survey was part of the qualitative analysis. Port Portfolio Analysis was used for competitive positioning of the ports. Benchmarking Analysis was used to establish a leader port using the pre-determined criteria and also for evaluating the variable involved for creating a benchmarking score. Lastly, the survey was held to recognise port competition determinants with respect to port stakeholder perspective.

In Chapter 5, the outcomes were obtained as per the explanations are given in the methodology section of chapter 4. These outcomes were evaluated, and it was inferred that Port of Hamburg is a “Mature Leader” in container segment. Furthermore, using the benchmarking score Rotterdam was established as a leader port using the pre-determined criteria and it was also inferred that Port of Hamburg’s benchmarking score was lower than the average port in Hamburg – Le Havre range. Moreover, Port Competitiveness Degree was also calculated, and the validity of the model was tested by performing a correlation between the benchmarking score and Port Competitiveness Degree. Finally, recognising the port competitiveness determinants in the case of Port of Hamburg a survey was carried out. The elements which challenge the Hamburg’s competitive position were also recognised.

In Chapter 6, research outcomes and answers to research questions are provided along with limitations to research and suggestions for further research.

6.1 Research Outcome and Answers to Research Question

The main research question can be addressed by answering the following sub-questions:

1. Which macro-environmental factors have a significant impact on the competitive position of the Port of Hamburg?

The challenge for Port of Hamburg is to minimize long-term uncertainties and understand opportunities associated with macro environmental impacts and retain competitive advantage. There are no suitable theories underpinning factors contributing to port performance. However, based on relevant literature review the macro environmental factors can be categorized under four heading.

a) Political-legal environment: Factors such as the rising tide of political interest in combining 'growth' with 'green', Supplier function. Government decisions regarding, supplier function, customer function and competitor function have created as well as eliminate many business opportunities.
b) Economic environment: Factors such as the increase in world trade, and its globalisation, together with Economies of Scale and growth in container vessel fleet, seaport cluster, monetary and fiscal policy altered the ways, and the directions, in which goods are moved at Port of Hamburg.
c) Technological environment: Factors such as technological developments significantly alter the demand for products or services. Technological change can decimate existing businesses can offer wide opportunities for improving goal achievements.
d) Social environment: Factors such as demographics, quality of life, consumer behaviour, stakeholder expectation, of business and assessing the assessing the changing values, attitudes, and demographic characteristics of stakeholders is an essential element in establishing organizational objectives

These factors indicate that the Port of Hamburg is faced by several challenges that need the formulation and implementation of adequate response strategies such as horizontal and vertical integration. As the macro environment is highly dynamic ports have to come up with their own response strategies considering their internal resources and capabilities available to remain competitive

2) Which are the essential determinants that can contribute to sustained advantage for the Port of Hamburg?

Port Portfolio Analysis and Benchmarking Analysis were incorporated for answering this research question. Moreover, the perspective of stakeholders was also taken into account which has been received through the survey. According to the outcome of Port Portfolio Analysis, Hamburg's key strength lies in containerised traffic and it is a "Mature Leader" by categorisation. Even the port authority of Hamburg substantiates the claim of containerised traffic being the most significant part of their overall traffic.

Furthermore, while performing benchmarking analysis and creating the competitive index it was observed that Hamburg's benchmarking score is less than the average port in the Hamburg – Le Havre range. In terms of competitiveness both

infrastructure and quality of services have to be focused on but, in this case, Hamburg's scoring is less especially due to the determinant of physical infrastructure as compared to Rotterdam. It was also evident from the analysis that Hamburg's feature criteria like total length of berth, surface area of container terminal and reefer points are almost half as compared to the "Star Performer" Rotterdam and in the recent years Antwerp has also overtaken Hamburg in these aspects thus placing Antwerp 2nd among Europe's top container ports. Thus, there is a need for Port of Hamburg to publish a new port development plan as the existing plan was published in 2012 and a major revision is required especially in the development of infrastructure segment for increasing its competitive advantage and replacing Antwerp position among European container ports. Therefore, the infrastructure determinant should be emphasised more among other determinants considered in the research.

Furthermore, from the perspective of the stakeholders the determinant of railway connectivity scored high points (2nd highest) and barge connectivity scored the lowest. Therefore, the Port of Hamburg should focus on these determinants for retaining its competitive advantage on railway connectivity and at the same time substantially try to improve their barge connectivity. Apart from that Hamburg has also scored moderate score of 3.64 in terms of environmental policy. Hamburg needs to step up its initiative in the field of sustainability and stimulate the process of transformation into a green port. Therefore, it is very important that the determinants which have scored the highest (information platform) need to be focused to retain their scoring and the determinant which has scored the least (barge transport connectivity) also needs to be focused to uplift the scoring substantially.

The other determinants understudy like port management, customs clearance procedures, road transport do contribute towards the competitiveness of port at a certain level, but the specific essential determinants mentioned above like infrastructure, quality of service, barge connectivity and railway connectivity should be looked at the most for gaining a sustained competitive advantage.

3) What strategy is needed for the Port of Hamburg for container throughput to increase market share and realize a sustained advantage in the Hamburg-Le Havre range?

The Port of Hamburg is responsible for marine and land-based infrastructure, port railway facilities safety of vessel traffic, property management and economic development of the port and the region. By developing and improving the elements under its responsibility, Port of Hamburg can increase market share and achieve competitive advantage over other ports in Hamburg – Le Havre range. The strategic plan for Port of Hamburg was mentioned in "Hamburg is staying on course 2025". But this strategic plan can be improvised by incorporating the strategies given below and would help Port of Hamburg change its status from "Mature Leader" to "Star Performer".

Thus, following strategies can be incorporated by Port of Hamburg:

i) Innovation – Firstly, (1) Port of Hamburg should come up with an innovation strategy which incorporates substantial technological changes in the existing system. The port intelligence level will be greatly enhanced by effectively and efficiently implementing Internet of Things (IoT). This would also help the port to create improvement in their supply chain operational efficiency by using automated port cargo handling, unmanned aerial vehicle port security monitoring and unmanned vehicle transport of goods. Secondly, (2) Port of Hamburg should promote business cooperation for accelerating innovation. The port should strategize in creating an open collaboration, intelligent ecosystem, high interconnection, deep data accumulation system. This will aid the supporting manufacturing industries to match to logistics industry and strengthen investments in innovation activities in the hinterland. Thirdly, (3) Maritime cybersecurity has been getting a lot of attention lately because of the global ransomware campaigns like “Wanna Cry” which affected various organizations worldwide including the Danish container giant, Maersk Line. The repercussions were so significant that business volumes were negatively affected and quarterly resulted were negatively impacted by around USD 250-300million. Moreover, in 2016, the custom systems of Port of Rotterdam were shut down, stopping operations for hours apparently to extort ransom. Therefore, the Port of Hamburg should step up its efforts for increasing safety in the maritime cyber security department and also create awareness among its employees for preventing such attacks. Fourthly, (4) The incorporation of “Blockchain and Cryptocurrencies” in the maritime industry has been the talk of the town and recently Maersk Line has also successfully tested its pilot project “Trade lens” in collaboration with IBM. Port of Hamburg should facilitate and help the terminals of HHLA and Eurogate to incorporate this new technology and to improve the efficiency of the overall supply chain. Lastly, (5) Start-up incubators should be given more emphasis to contribute towards an ecosystem that creates value for all stakeholders and this would be a significant contribution to the field of innovation. Port of Hamburg should intensify its mentorship programme and also attract more investors and corporate partners. It can also take up the initiative of joining world port accelerators programme such as PORTXL of which Rotterdam and Amsterdam are already a part of. Thus, this would be very important for creating an innovative ecosystem wherein innovate companies can develop.

ii) Sustainability – This is one of the most significant strategies which Port of Hamburg should incorporate for achieving the aim of truly becoming a “Green Port”. Moreover, HHLA was named as Best Green Container Terminal Operator by Asia Cargo News in 2017. Thus, future strategies are required to keep Port of Hamburg in the list of European Ports leading in the sustainability sector. This strategy is extremely important for the sustainable symbiosis of port, city and environment. Thus, reducing the CO2 footprint and for sustainable management of traffic and

energy. Firstly, (1) Even though Hamburg already has Green Automated Guided Vehicles (AGV's) and electric vehicles but more such green vehicles should be utilized for port operations. Secondly, (2) Port of Hamburg has already incorporated its emission-free container terminal plan in HHLA's Container Terminal Altenwerder should incorporate the plan in other container terminals as well. Thirdly, (3) Port of Hamburg should facilitate the development of infrastructure for LNG bunkering thus it should aim for Hamburg to become LNG bunkering hub for vessels. Lastly, (4) Emphasis should be laid on improving the barge connectivity system as it will help to reduce emission contribute by road transport.

iii) Vertical Land Strategy – As it can be observed from the benchmarking analysis performed in this research, Port of Hamburg is almost at par in terms of feature criteria as compared to Port of Antwerp but the difference of an overall number of containers handled in 2016 was about 1 million. Thus, Port of Hamburg should focus on vertical group strategy for improving the handling efficiency, coordination of the logistics chain and increasing productivity of overall operations.

iv) Corporatized Port Authority – The effects and outcomes of corporatization have been positive in the airport industry and also in maritime industry. There is a need for port reform due to the declining position of Port of Hamburg. The port authority needs to be publicly owned but more corporatized thus enabling it to act like an independent operating company. Thus, emphasis should be laid on reforming the relationship between port governance and performance. This decision of reformation can be validated by analysing the performance parameters like market share, investments, turnover, operating costs and profits. Thus, by corporatisation, it is expected that Port of Hamburg would have a positive impact on its turnover and revenues.

v) Transparency –The United Nations (UN) estimates that corruption can add 10% or more to cost of doing business internationally (Delloite, 2015). The Port of Hamburg should incorporate the highest level of transparency into their corporate activities. Port of Hamburg should also encourage its stakeholders to become part of initiatives like Maritime Anticorruption Network (MACN) and provide more authority to internal corruption prevention committee for them to work according to Hamburg Corporate Governance Code (HCGC).

vi) National Port Concept – Port of Hamburg should actively contribute towards National Port Strategy plans with close collaboration with Port of Bremerhaven even though it is one of the competitors for the Port of Hamburg. This would surely contribute towards eliminating bottlenecks in sea and land networks on German inland ports and seaports of international significance

6.2 Limitation of Research

This research has got certain limitations as the some of the points being planned at the beginning was not executed at a later stage. The discrepancies in the traffic data availability are one of the significant constraints which was encountered while doing the data collection. The observations made from the outcome of port portfolio analysis would have been more concrete if the data would have been available for the year 2017. The port authorities were requested to provide the data for the same but unfortunately, no reply was obtained from their side. As the ports being studied are geographically located quite far from each other it was not possible to make visits to the ports personally. Therefore, the analysis was carried out for the period of 10 years from 2006 to 2016. With respect to benchmarking analysis as well some of the factors were not taken into consideration because of unavailability of data like storage capacity of the container in the port. These data would have really enriched the research and would have helped the author to achieve definitive results by developing the present study. Also, Google survey form was used as the method for collecting information rather than conducting personal interviews. Moreover, as personal interviews were not conducted it was difficult to get an insight into the perspective of the industry experts which would have been a significant value addition for the research. As a result, it can be stated that these factors have resulted in lowering the validation of the results. Moreover, the overall analysis could have been more detailed if the cost element was taken into account. Nevertheless, taking these factors into consideration further research can be conducted on this topic.

6.3 Final Conclusion and Suggestions

The researcher was successful in addressing “How can the Port of Hamburg maintain its competitive position in Hamburg – Le Havre area with continuous growth of container vessels?”. The research focuses on the Port of Hamburg among the four other major ports in Hamburg – Le Havre range for the period of ten years (2006-2016). Hamburg has surfaced as “Mature Leader” and has demonstrated growth which is less than the average annual growth of ports in Hamburg – Le Havre range. The overall outcome can be improved if the Port of Hamburg comes up with a new port development plans focusing on the determinants evaluated in the study for achieving customer and port stakeholder-centric solutions. Thus, it is significant that their actions stay in line with the strategic plan for improving port competitiveness and performance.

The research was thus able to add more knowledge to the existing literature and would be of great value addition to academicians and port authorities. There are sections of port competitiveness which need to be explored especially focusing on the cost factor. By analysing the cost factor, the overall evaluation can be highly enriched and may create significant value addition for the topic of port competition.

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Appendices

Port Portfolio Analysis: Data

1) Port of Hamburg

Year	LB	DB	CONT
	Growth Rate		
2006-2007	8.39	2.5	11.7
2007-2008	7.82	1.2	-1.5
2008-2009	-7.59	-2.9	-28
2009-2010	-1.91	6.4	12.4
2010-2011	-0.62	-3	14.3
2011-2012	-0.28	2.4	-1.6
2012-2013	3.76	3.9	4.6
2013-2014	-2.09	-0.6	5.1
2014-2015	-1.52	1	-9.5
2015-2016	2.15	-2.9	0.9
Average Annual Growth	0.811	0.8	0.84
Total Average Annual Growth	0.817		

Year	LB	DB	CONT
	Percentage Of Total		
2006-2007	12.2	22.8	62.6
2007-2008	13.1	22.4	62.1
2008-2009	15.2	23.4	58.7
2009-2010	13.5	24.7	59.1
2010-2011	12.3	22.2	63.3
2011-2012	12.3	22.3	63.5
2012-2013	12.1	23	63.4
2013-2014	11.3	22.5	64.6
2014-2015	11.7	26	60.8
2015-2016	11.9	25.3	61.5

2) Port of Bremerhaven

Year	LB	DB	CONT
	Growth Rate		
2006-2007	-0.41	-19.54	9
2007-2008	4.16	-17.14	11.6
2008-2009	-44.03	27.59	-16.5
2009-2010	-16.89	12.16	6.7
2010-2011	14.97	75.9	21.7
2011-2012	-6.05	-3.42	3.4
2012-2013	2.97	-21.28	-4.7
2013-2014	59.13	7.21	-1.6
2014-2015	-0.3	5.88	-4.6
2015-2016	58.48	-3.97	0.8
Average Annual Growth	7.203	6.339	2.58
Total Average Annual Growth	5.374		

Year	LB	DB	CONT
	Percentage Of Total		
2006-2007	0.9	0.2	88.9
2007-2008	0.8	0.1	89.3
2008-2009	0.5	0.2	92.6
2009-2010	0.4	0.2	91.7
2010-2011	0.4	0.3	91
2011-2012	0.3	0.2	90.8
2012-2013	0.4	0.2	90.2
2013-2014	0.6	0.2	89.5
2014-2015	0.7	0.3	88.7
2015-2016	1	0.2	88.9

3) Port of Le Havre

	LB	DB	CONT
	Growth Rate		
2006-2007	-2	33.02	26.7
2007-2008	2.4	-4.58	-6.4
2008-2009	-2.9	-16.58	-10.1
2009-2010	-4.3	-12.77	5
2010-2011	4.2	-9.95	-6.2
2011-2012	-5.8	-7.55	-10.1
2012-2013	3.8	-49.2	9.5
2013-2014	1	5.01	11.3
2014-2015	-1.9	6.5	5.2
2015-2016	1.9	17.56	-3.1
Average Annual Growth	-0.36	-3.854	2.18
Total Average Annual Growth	-0.678		

Year	LB	DB	CONT
	Percentage Of Total		
2006-2007	62.1	6.6	29.7
2007-2008	64.7	6.2	27.2
2008-2009	65.8	5.6	26.6
2009-2010	64.4	5.2	29
2010-2011	65.3	4.8	28.3
2011-2012	61.6	4.8	28.9
2012-2013	60.7	2.2	29.2
2013-2014	61.7	2.5	34.3
2014-2015	63.7	2.6	32.5
2015-2016	62.6	3.1	32.8

4) Port of Antwerp

Year	LB	DB	CONT
	Growth Rate		
2006-2007	4.3	0.5	17.3
2007-2008	-2.4	-0.5	6.3
2008-2009	0.2	-5.5	-16.3
2009-2010	4.5	2.6	16.1
2010-2011	-3.1	-1.8	2.1
2011-2012	2.8	-0.4	-1.7
2012-2013	7.2	-5.4	1
2013-2014	2.5	-1	6.7
2014-2015	1.2	0.6	6.3
2015-2016	-2	0.5	5.6
Average Annual Growth	1.52	-1.04	4.34
Total Average Annual Growth	1.606666667		

Year	LB	DB	CONT
	Percentage Of Total		
2006-2007	23.7	14.6	46.1
2007-2008	22.8	15.8	48
2008-2009	27.4	12.1	50.1
2009-2010	25.3	12.1	52.3
2010-2011	26.9	11.3	51
2011-2012	27	11.4	51.1
2012-2013	34.1	8.3	48.5
2013-2014	34.6	7.5	50
2014-2015	34.8	7.3	50.2
2015-2016	34.4	6.3	51.4

5) Port of Rotterdam

Year	LB	DB	CONT
	Growth Rate		
2006-2007	1.6	3.3	12.5
2007-2008	-1.1	-1.1	-1.3
2008-2009	1.7	2.5	-9.9
2009-2010	3.3	-3	15
2010-2011	-2.5	2.8	2.9
2011-2012	1.7	-0.7	0.7
2012-2013	-2.3	6.3	-3.5
2013-2014	2.4	-3.2	5.6
2014-2015	1.4	0.4	-0.5
2015-2016	-0.2	-0.7	0.8
Average Annual Growth	0.6	0.66	2.23
Total Average Annual Growth	1.163333333		

Year	LB	DB	CONT
	Percentage Of Total		
2006-2007	49.2	23.7	21.9
2007-2008	49.4	24.4	21.6
2008-2009	54.6	18.1	22.5
2009-2010	52.9	20.5	21.7
2010-2011	47.7	20.7	25.2
2011-2012	50.9	18.1	25
2012-2013	48.3	20.9	24.3
2013-2014	47.3	20.2	25.4
2014-2015	49.6	18.9	24.1
2015-2016	50	17.9	24.6

6) Data for plotting graphs

Figure : 5.1 ,Graph for total traffic structure	Le Havre	Bremerhaven	Antwerp	Rotterdam	Hamburg	Average
Avg. Annual Growth	-0.678	5.374	1.606667	1.163333	0.817	1.6566
Avg. Market share	5.6	6	17	38.1	11.3	15.6

Figure : 5.2 ,Graph for Hamburg	LB	DB	CONT	Average
Avg. Annual Growth	0.811	0.8	0.84	0.817
Avg. Market share	1.6	13	20.8	11.8

Figure : 5.3 ,Graph for Rotterdam	LB	DB	CONT	Average
Avg. Annual Growth	0.6	0.66	2.23	1.163333333
Avg. Market share	51.3	36.4	29	38.9

Figure : 5.4 ,Graph for Bremerhaven	LB	DB	CONT	Average
Avg. Annual Growth	7.203	6.339	2.58	5.374
Avg. Market share	1.96	1.4	12.7	5.353333333

Figure : 5.5 ,Graph for Le Havre	LB	DB	CONT	Average
Avg. Annual Growth	-0.36	-3.854	2.18	-0.678
Avg. Market share	9.2	2.9	5.9	6

Figure : 5.6 ,Graph for Antwerp	LB	DB	CONT	Average
Avg. Annual Growth	1.52	-1.04	4.34	1.606666667
Avg. Market share	15.2	5.7	26	15.63333333

Figure : 5.7 ,Graph for Structure of container traffic	Le Havre	Bremerhaven	Antwerp	Rotterdam	Hamburg	Average
Avg. Annual Growth	2.18	2.58	4.34	2.23	0.84	2.434
Avg. Market share	5.9	12.7	26	29	20.8	18.88

Figure : 5.8 ,Graph for container traffic vs port traffic	Le Havre	Bremerhaven	Antwerp	Rotterdam	Hamburg	Average
Avg. Annual Growth	2.18	2.58	4.34	2.23	0.84	2.434
Avg. Share in port traffic	29.85	90.16	49.87	23.63	61.96	51.094

7) Questionnaire

Survey On "Competitive strategy for Port of Hamburg in container throughput: Analysis of port competitiveness in the Hamburg-Le Havre range"

Dear Sir/Madam,

I would highly appreciate if you would take out some time to provide some general information as well as rate some of the statement regarding to my thesis research topic," Competitive strategy for Port of Hamburg in container throughput: Analysis of port competitiveness in the Hamburg-Le Havre range." The result of the questionnaire is very important to me since it determines the final conclusion of my thesis research. Thank you for your kind help in advance.

Alan Alexander
MSc In Economics and Logistics
Erasmus University Rotterdam

General Information

1. Respondent:
2. Company:
3. Company Activity:
4. Function:
5. Experience (year):
6. Background (Engineering, Operations, Financial, Entrepreneur etc.):
7. Average size of previous projects (in $):

Kindly read each of below determinants and indicate to what extent you would rate each determinant listed below that affects the competitive position of Hamburg with respect to its competitors, Rotterdam, Antwerp, Le Havre, Bremerhaven (containerized traffic). There Excellent represents 5 points, Above Average represents 4, Average is 3, Below Average is 2 and Very Poor is 1.

Kindly rate Port of Hamburg competitive positioning for the following:

		Excellent	Above Average	Average	Below Average	Very Poor
1.	Geographical Location					
2	Maritime/Foreland Connections					
3	Physical Infrastructure					
4	Range and Quality of services offered in the container terminals					
5	Customs Clearance Procedures					
6	Delays in Cargo Inspections					
7	Barge Connectivity					
8	Road Transport Connectivity					
9	Rail Transport Connectivity					
10	Port Management and Administration					
11	Environmental Management Policy					
12	Port of Hamburg 2025 Plan					
13	Relationship Port/City					
14	Information Platform (https://www.hafen-hamburg.de/)					
15	Overall Rating					