The development of port hierarchy in West-Africa

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Abstract

The global maritime industry is a dynamic field of business that has seen fundamental changes in recent years such as globalization, containerization and impressive growth rates in seaborne transport volumes. Moreover, the fate of ports is more and more determined by outsiders, such as shipping lines and freight-forwarders. These port users choose their port of call based on numerous selection criteria, such as efficiency, infrastructure and location. These choices change the existing hierarchal port network that is generally organized in hub-and-spoke systems with each port being classified according to its characteristics. This thesis investigates the development of the hierarchy in the West-African port system focused on the ports of Tema, Abidjan, Dakar and Lagos. A factor that is specifically important for this region is the level of political instability. It can be concluded that the port of Abidjan is most preferable in attaining the future status of West-African hub port. Lagos shows promising developments as well, although their high level of political instability is a major challenge they have to tackle first.

Contents

Chapter 1 - Introduction

The port and maritime industry has always been a dynamic field of business. Over 90% of world's trade is carried by sea (International Maritime Organization, 2013). Hence, developments in this area are crucial. Port and maritime studies have observed a change in hierarchy within the global port system in recent years. Many factors serve this change, such as globalization, containerization and technological revolutions in the specific industry. This thesis investigates the hierarchical evolution of the West-African port system. West-Africa was chosen as a focus because of the many interesting developments that are taking place. A good example is the number of international (maritime) investments that are destined for this area, such as the construction of a second container terminal in the port of Lagos, the multi-purpose Lekki Port. These investments trigger important change in the historical port system that West-Africa has known for years. Another reason why this market is especially interesting is the robust growing economy. Several West-African countries even show growth rates of above 7% (African Development Bank, 2014). West-Africa is an example of an economy outside of the developed world that started to show impressive growth rates in recent years. This triggered certain changes in the maritime industry (further elaborated on in chapter 2), such as a growing focus on North-South routes, in contrast to the already existing East-West routes that connects the developed regions in the world. As a result, West-Africa as a region gradually enters the world stage. The focus of this thesis will revolve around the following research question:

'*How will the hierarchy within the West-African container port system change in the coming years based on specific port selection criteria?*'

To come to this conclusion, there are several parts within this field of study that will be highlighted in order to answer a number of sub-questions. Chapter 2 will answer the sub-question: *'How is port hierarchy determined from the perspective of shipping lines and freight-forwarders?'* This sub-question will be tackled through a literature review. What role does containerization play in this development and what is the effect on shipping lines and freight-forwarders on the one hand, and the effect on port management on the other? Which criteria on port selection are defining for the hierarchal structure in the port system? This part will create a framework to which the West-African ports can be tested later on. Chapter 3 will answer the sub-

question: *'What categorizes the present West-African port system?'* by elaborating on its historical development and the current situation. To narrow down this desk-research, there will be a focus on the following West-African ports: Tema (Ghana), Abidjan (Ivory Coast), Dakar (Senegal) and Lagos (Nigeria). This focus was chosen because these ports are the biggest four in the region in terms of container traffic according to numerous policy reviews and statistical reports. Moreover, it was possible to gather qualitative and statistical information on these specific ports to actually conduct the desk-research, which is not always possible for ports in developing countries. Moreover, chapter 3 will contain an overview of the planned investments in the four ports in order to create a picture of the ports' future developments. Finally, in the discussion in chapter 4, all four ports will be tested against the framework of port selection criteria set up in chapter 2 in order to predict their position within the future hierarchy of the West-African port system. Consequently, the following sub-question can be answered: *'What position will Tema, Abidjan, Dakar and Lagos take within the future West-African port system?'*

Numerous sources have been used to conduct this research. The theoretical framework was based upon academic papers that were dedicated to the subject of port hierarchy and port selection criteria. For the empirical framework, numerous academic researches as well as reports from development organizations such as the World Bank Group and the United Nations Conference on Trade and Development (UNCTAD) were consulted. Moreover, statistical evidence was generated from reports published by the port authorities in question, namely Tema, Abidjan, Dakar and Lagos.

To create an overview, the rest of the thesis will have the following outlook:

Chapter 2 – The determination of port hierarchy from the perspective of shipping lines and freight-forwarders

Chapter 3 – An overview of the present West-African port system and concise port profiles of the ports of Tema, Abidjan, Dakar and Lagos

Chapter 4 – A summary of the findings of chapter 3 and a discussion on the future position of the four ports studied

Chapter 5 – A conclusion on the future development of the West-African port hierarchy and further recommendations

Chapter 2 - How is port hierarchy determined?

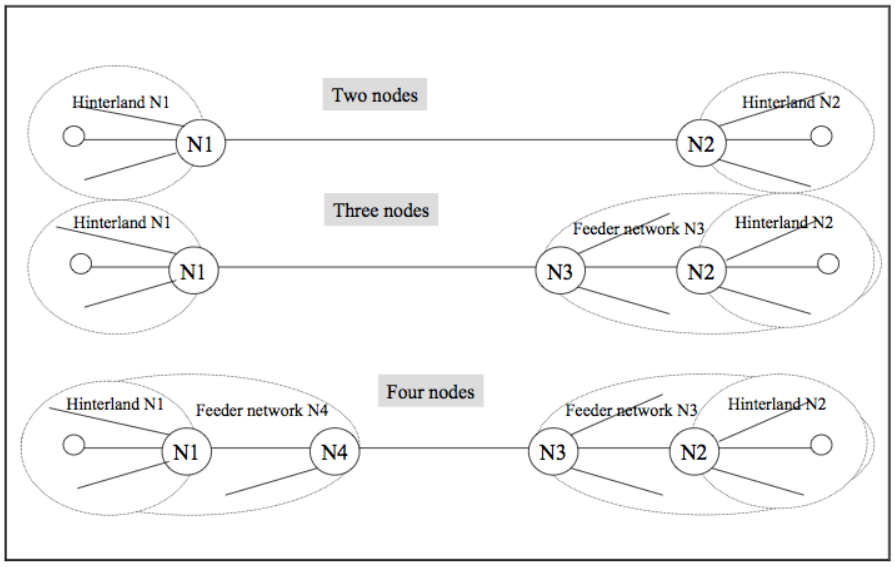
This section contains an elaboration on how hierarchy within the port sector is determined.

Every port belongs to a certain group that is interconnected on a regional, national and/or international scale (Hoyle & Charlier, 1995). Hierarchies within the global port system can be seen as an illustration of broader ongoing processes that reflect phenomena such as the globalization of business cycles. It is therefore important to understand which events lead to the existence of this hierarchy and which factors influence and determine this order.

Port hierarchy

One fundamental development within the maritime trade industry was the appearance of containerization. The implementation of this technological revolution resulted in changing relationships among different countries and regions and the accompanying ports. The container system, which was widely introduced after World War II, dramatically reduced international transport costs (Hummels, 2007). The container was developed as such that it could carry many kinds of cargo on the same ship. Also, all these different kinds of cargo could be transported with significantly less damage. Most importantly, the container has a standardized size, which allows the containers to be transferred to another ship or other means of transport without the need of being unpacked. This feature shortened transport times considerably. Implementing this container system required high capital investments in container ships and handling tools. As a result, spatial concentration among port cities occurred. A few ports in each region invested heavily in the containerization process, while other ports in the same region became of marginal importance. The ports that made the commitment to the containerization were generally located near large markets of economics interest and/or the main global maritime routes (Guerrero, 2014). This development, among others, lead to the foundation of hub-and-spoke systems within the global port system. Within this system, a number of ports serve as so-called ‘hubs’ where the cargo is divided up into smaller batches which in turn are transported to smaller ports via so-called ‘spokes’. Figure 1 contains a visualization of this system. As can be seen, a system must at least contain two nodes. However, more complex systems with 3 of more nodes are also possible.

Figure 1 – Hub-and-spoke system



Source: De Langen, Nijdam & Van der Lugt. Port Economics, Policy and Management.

This network of liner shipping routes is continuously changing and getting more complex. The increase in number of container ports, increase in number of transport volumes and the increase in ship size all feed this complexity as more and more combinations of routes and opportunities within the network arise. To understand the port hierarchy within this network, a distinction can be made among the different ports present in the network (De Langen, Nijdam & Van der Lugt, 2012). In the literature, the distinctions are different however in many ways similar to each other. One clear distinction that is used in this research contains four types of ports: global pivots, load centres, regional ports and minor ports. All these ports are classified according to the following characteristics: location, hinterland and service. In literature, these criteria are found to be very important for port clients when choosing their port of call, as will be explained in the next section. In table 1, the characteristics of the different types are clearly indicated. Global pivots are located on or near the main routes in the maritime network and their lines only connect a few ports that also classify as global pivots. Transshipment is the main function of these ports. Load centres are not necessarily located on the main routes in the network and the function of hinterland transport is more important than transshipment. Regional ports only serve the function of hinterland transport. Their location generally is strategic (near manufacturing and moderate populated regions), which gives them the potential to develop into a load centre in case volumes

increase. Lastly, minor ports are small container ports that have developed near a small manufacturing or minor populated region where volumes have become sufficient.

Table 1- Characteristics of four types of port

Aspect	Characteristic	Global pivot	Load centre	Regional port	Minor port
Logic of location	Maritime network	Located strategically nearby (intersection of) major shipping routes	Peripheral in maritime network	Unimportant position in maritime network	Unimportant position in maritime network
	Hinterland network	Limited natural hinterland	An extensive and voluminous hinterland	A substantial industrial/metropol itan hinterland	Local traffic base
Hinterland and transhipme nt role	Transhipment	> 60% (sea/sea) transhipment	< 40% sea/sea transhipment	Hardly sea/sea transhipment	No transhipment
	Hinterland modes	Limited local hinterland	> 60% direct to hinterland substantial share (at least 10%) of origins/destinati ons > 300 km	At least 90% of the volumes with origin/ destination < 500 km	Direct local hinterland, at least 90% of the volumes with origin/ destination < 100 km
	Intermodal connections	Intermodal connections of limited importance	Intermodal connections important in modal split	A limited number of intermodal services	Hardly any intermodal facilities
Service characterist ics	Vessel size	Largest vessels at least 5,000 TEU	Largest vessels at least 4,000 TEU	Largest vessels between 2,000 and 4,000 TEU	Largest vessels up to 1,000 TEU
	Service calls	Frequent calls of major services, in some cases dominance of one shipping line	Frequent calls of major services of a number of shipping lines	Calls of secondary services (shortsea, feeder and secondary intercontinental services), a small number of calls of major services	Feeder and shortsea services
	Minimal annual volume	> 600,000 TEU	> 1 mln. TEU cargo	> 150,000 TEU	< 200,000 TEU

Source: De Langen, Nijdam & Van der Lugt (2012)

With the decrease in classification (from global pivot to minor port), the size of the hinterland also decreases.

Port users

Ports fundamentally serve two types of clients: shipping lines and freight-forwarders. As a result of containerization, these clients preferred the concentration of trade and services at particular destinations, which in turn increased inter-port competition. Shippers and freight-forwarders

choose a certain port as their port of transshipment or as their port of destination for handling their cargo based on several factors. For port authorities it is thus crucial to be aware of these factors so that they can anticipate to their users wishers. Based on these factors, a port authority can formulate a positioning strategy that differentiates the port from its competitors and will make clients choose for the port in question (Ugboma, Ugboma & Ogwude, 2006). As a result, an important phenomenon in the modern maritime industry can be seen: port development occurs with a more exogenous character. As shipping lines and freight-forwarders generally choose their port of call based on factors they consider important, it follows that the destiny of ports of is more and more decided on by outsiders.

There have been numerous studies on these port selection criteria that form the basis of the port positioning strategies. In the following section, a distinction will be made between the port selection criteria for shipping lines and the port selection criteria for freight-forwarders. The interaction that takes place between the shipping lines and the freight-forwarders is an essential collaboration to keep in mind. Freight-forwarders make use of the shipping lines to transport the cargo to their customers. In this process, it is the shipping liner company they choose first, where after they choose the port out of the ports used by the concerning shipping line (De Langen, 2007). Hence, it is important that ports know how to attract the shipping lines in order to also win the freight-forwarders as clients.

Shipping lines

Tongzon (2007) has made an attempt to map the factors from the perspective of shipping lines and, more importantly, weigh these factors according to importance. One approach that can be used to weigh all the different factors is the ‘revealed preference method’. In this method, the behavior of shippers and their choices made are observed. Consequently, the preference among different relevant factors such as port efficiency, costs, service, location and connectivity to the hinterland can be derived. This method is then combined with a ‘stated preference approach’, where shippers are asked to give their preference among the different factors in some kind of survey or questionnaire. To draw final conclusions from these two methods, it is important to look for consistencies within the shippers’ preferences.

From the study on 'stated preference' that Tongzon has executed, it can be concluded that 'efficiency' is the prime most important determinant for a shipper's choice. In other studies, 'efficiency' (or 'time') also comes forward as the most important criteria for a port call (Pálsson, Harding & Raballand, 2007; Ugboma, Ugboma & Ogwude, 2006). In second place, port charges and connectivity are equally important. Location comes as the third most important factor. Next, infrastructure is put fourth, wide range or port services fifth and cargo size sixth. However, in the 'revealed preference approach' it turned out that some factors were insignificant. For example, cargo size is a factor that lost significance since the financial crisis of 2008. As a result, shipping lines have difficulties in filling their vessels with enough freight. Connectivity turns out to be insignificant because this factor is actually only important to freight-forwarders, who need to transport the cargo to the hinterland. Although some studies indicate that quality is always more important than price, this is not a general statement that can be accepted. Nowadays, it is both quality and price and hence the total package that counts and makes a shipping line choose for a certain port. In conclusion, when leaving out the insignificant factors, the following criteria in order of importance can be drawn up for the shipping liner companies:

1. efficiency
2. port charges
3. infrastructure
4. wide range of port activities

Freight-forwarders

Most of the studies on preferred criteria concerning port selection are conducted from the shipper's point of view. Research on criteria preferred by freight-forwarders is marginal. However, freight-forwarders are important clients for ports and thus it is important that their preferences are taken into account as well when ports want to win in the fierce competition that exists within the industry nowadays. There are some studies that focused on the freight-forwarders preferences when it comes to port selection. Among them are Tongzon (2009) and De Langen (2007). From these studies, the following order in importance of criteria can be drawn up:

1. efficiency
2. shipping frequency
3. adequate infrastructure
4. location

When comparing both orders of preference from the shipping lines and the freight-forwarders, it can be concluded that 'efficiency' is the prime most important factor for both parties. However, the difference concerning the other criteria has to do with the type of work both parties are involved in. Since freight-forwarders need optimal transportation into the hinterland, their preferences have to do with this kind of transport. The 'shipping frequency' factor has to do with the number of ships that call at the port in question and consequently, can be used by the freight-forwarders for transporting their cargo inland. The shipping lines, on the other hand, weigh importance to the factors that make their call at the port in question most cost effective and comfortable as possible. The hinterland connectivity is not as important to them. The difference in preferences is clearly stated in table 2. Concluding, the criteria of efficiency and infrastructure (including port facilities) are crucial to both parties that are important clients of ports. Combining this conclusion with the criteria from table 1, we can draw up a number of criteria that will have a focus in this thesis. First of all, infrastructure (including port facilities) also embraces services, a criterion from table 1. Moreover, the hinterland connectivity can be included in the location criterion, as the location of a port generally is a determinant of its hinterland connectivity. Ultimately, the criteria of *efficiency, infrastructure* and *location* will among others be a focal point in the rest of this thesis.

Table 2 – Port selection criteria of shipping lines and freight-forwarders

Port selection criteria	Forwarder (%)	Shipper (%)
Frequency and quality shipping services	92*	44
Efficiency of port	58	67
Location port	75*	22
Risk of delay in other port	25	67*
Connection to hinterland services	67*	22
Equipment of port	58*	11
Customer focus in port	25	11
Personal relations	0	0
* Significantly more frequently mentioned than other actor, P< 0.05		

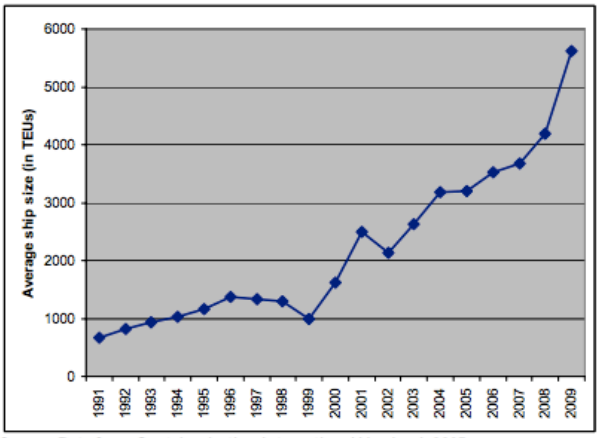
Source: De Langen, 2009

Changes in the industry

Once shipping lines have decided for themselves which factors they find important, potentially being unaware of some of them, they will define their business strategy. The last 20 years have shown impressive growth rates in the maritime industry in the framework of economies of scale, which changed a lot in the industry's business environment as was known before. The first notable occurrence is the growth in firm size of these companies. This growth can be realized in

two different ways: internally and externally. Internal growth is facilitated by investments in more and bigger vessels. In recent years, the average ship size has grown exponentially, as can be seen in figure 2. External growth, on the other hand, follows from Mergers & Acquisitions and the set up of strategic alliances. The internal growth in a way stimulated the external growth in the shipping-liner sector. In the past, the most important global trade routes were along the East-West line. However, as trade opportunities opened up and more economies outside of America and Europe started to grow and joined the global trade, a focus grew towards the North-South routes (Guy, 2003). At the same time, shipping lines invested in larger ships. To facilitate the North-South routes, the current ships on the East-West routes were replaced with the new, large vessels and the old ships were deployed on the North-South routes. This spatial expansion was assisted by cooperation between shipping lines in the form of strategic alliances, resulting in external growth and a hub-and-spoke system that linked the important East-West trade area with the secondary North-South region. Another factor that encouraged this hub-and-spoke system has to do with the introduction of the larger vessels. Shippers increasingly decide to call only at a few large ports, thus serving as hubs, which can handle vessels of such large size (Loo & Hook, 2002). Consequently, there is a reduction in the number of port calls shipping lines make and an even clearer distinction among the function of the different ports in the hub-and-spoke system.

Figure 2: trends of average ship size



Source: Data from Containerization International Yearbook 2005.
Data based on ships orders for 2006 and beyond.

Next to the growth of and within shipping-liner companies, there are several other noticeable changes that influenced the port industry in recent years. As mentioned before, there are many factors that influence a shipper's choice to call at a certain port. Due to the fact that regions are

more and more integrated, hinterland areas start to overlap. Therefore, inter-port competition has become fiercer and as a result, several factors have gained more importance at the expense of other aspects (Sánchez & Wilmsmeier, 2010). For example, in the earlier days it was considered important that a port was located near to an economic region and, subsequently, provided adequate connectivity to this hinterland. However, today this is not considered as important anymore. The accessibility of the port and the technological performance and provided services are examples of factors that have grown significantly in importance due to the changing environment of increasing competition among ports. As a result, in literature we find that ports are begin treated as an isolated entity, which operates on its own within their cargo handling business. Still, hinterland connections are a major determinant of the efficiency of ports. This factor seems to be more and more ignored in today's literature on port hierarchy and efficiency (Ducruet, Notteboom & De Langen, 2009). Moreover, the development of ports has become more complex in recent years due to the fact that there are multiple parties involved. Not only shipping lines, but also port authorities and governments want a share in the decision-making process. One interesting development in interaction of these different actors is that the position of port authorities seems to weaken because of the growing decisional-power of large multinationals such as the maritime companies and the terminal operators (Sánchez & Wilmsmeier, 2010).

Lastly, one factor of major importance, and specifically relevant for this thesis, is the growing importance of social-political factors. Only taking into account economic factors is not sufficient anymore to understand port development, especially in a region like West-Africa, where social and political conflicts are not uncommon. In literature, they assess these regions according to the level of *political instability*. In countries where the political environment is instable, with a high risk of conflicts, the investment climate is generally unfavorable (Darley, 2012). Therefore, political stability is another factor that will have a focus in this thesis when assessing the West-African ports. In the next section, there will be an empirical elaboration on the (historical) development of the West-African port system and the current reform that is taking place, with a focus on four specific ports in the region. Thereafter, a discussion will enlighten more on how these ports will develop and what position they will occupy in the West-African port system in the future, in combination with the literature of this chapter.

Chapter 3 - The West-African port system

Historical background

West-Africa has a marginal position within the global economic system. However, as a result of globalization, significant changes are going on that will influence its position in the global network. To better understand the position of West-Africa within the maritime industry, it is important to understand its historical background. The colonial past plays an important role in this matter. Countries that have colonized West-Africa in the past exploited the region economically and port infrastructure was developed in order to facilitate colonial trade. This system was set up with marginal investments, in order to maximize profits. Therefore, after the colonial period the region was left with only a number of small ports with weak facilities (Debrie, 2012). From the 1980s, public authorities started to pull back from the port planning processes and the IMF and the Worldbank (two major global monetary institutions) initiated structural (macro)-economic and financial changes. These changes affected different sectors of the society, but what they all had in common was the reduction of public involvement and the creation of incentives for private investments. It is believed that private intervention will increase efficiency within the port process by increasing competition. In general, both the private and public sector are involved in port operations. The private sector, in the form of logistic service providers and terminal operators, tries to gain control over port operations by organizing themselves on a global scale (Van Niekerk, 2005). Within the port sector specifically, the Worldbank initiated a so-called Build, Operate and Transfer (BOT) system. Algarni, Alditi & Polat (2007) define the BOT system as follows: a system in which a private party finances the design, construction, maintenance and operation of a public project for a specific period of time. At the end of this period, it transfers the ownership to a governmental institution. In this transfer, the private party hopes to make profits. With this system, the Worldbank desired to attract foreign investors to develop the ports and the accessory infrastructure network.

Two examples of foreign parties that took part in the program were Bollore African Logistics and Maersk-Sealand (Debrie, 2012). Bollore set up a strategy that involved vertical integration by accomplishing a number of mergers & acquisitions. From then on, Bollore performed numerous port activities from cargo handling to railway operations and inland transportation. Soon, Maersk-Sealand group followed with a similar structure. Mearsk-Sealand has been present in the West-African market from 1986 when it got involved in the ports Dakar (Senegal), Abidjan (Ivory

Coast) and Lome (Togo). As a result from imitating Bollore's strategy, it also set up joint ventures with Bollore, whilst in other regions they were strict competitors. In the last years, competition has grown even further because of increased port concessions that lead to more and more private investments in the terminal operations. Among them are Dubai Ports World, Mediterranean Shipping Company, China Ocean Company and CMA-CGM. Table 3 shows a list of all port concessions made from 2004 in West-Africa.

Table 3 – Spread of port concessions

PORTS	TERMINAL OPERATORS	TERMINAL CONCESSIONS
Dakar	Dubai ports world	2008 (25-year concession)
Conakry	Bollore	2011(25-year concession)
Abidjan	Bolloré/AP Moller (Maersk)	2004 (15-year concession)
Tema	Bolloré/AP Moller (Maersk)	2007(20-year concession)
Lomé	MSC/GETMA	2009 (35-year concession)
Cotonou	Bollore	2009 (25-year concession)
Lagos (Tin Can)	Bollore	2005 (15-year concession)
Lagos (Apapa)	AP Moller (Maersk)	2005 (25-year concession)
Monrovia	AP Moller (Maersk)	2010 (25-year concession)

Source: Port authorities, World Bank, 2011.

Global trade patterns and the growing role of West-African ports

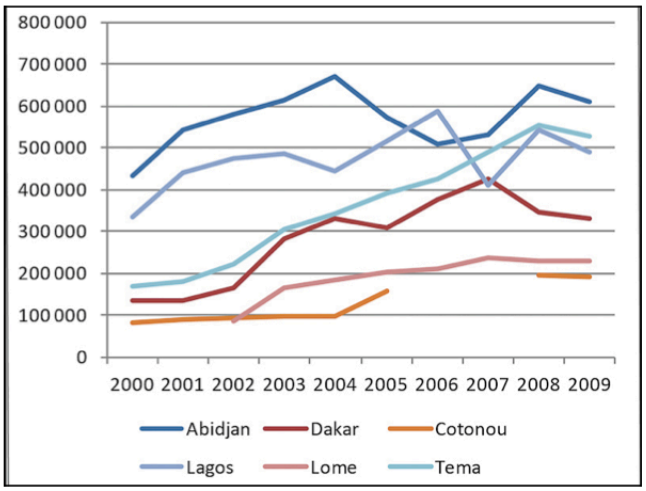
This increase in private parties present in the ports is affecting the whole of Africa. According to a an article released by McKinsey in 2010, the rate of return on foreign investment in Africa in general is higher than in any other developing region in the world (Leke, Lund, Roxburgh & Wamelen, 2010). One key reason for this economic surge is the change in governmental behavior. They increasingly adopt policies that will boost the market, such as privatizing state-owned enterprises, lowering corporate taxes and most importantly, increasing the openness of global trade. From 2000 to 2008, annual foreign direct investment increased from $9 billion to $62 billion. Formerly, the European market was the most important market for trade. In 2000, a conference was set up between numerous carriers that operated in the Europe – West-Africa trade routes: the Europe West Africa Trade Agreement (EWATA). The goal was to stabilize trade rates between the two regions. West-Africa's most important export product is oil. Today, however,

Asia is growing significantly in importance and half of Africa's trade is now with developing countries (Pálsson, Harding & Raballand, 2007). West-Africa profits most from a continuous rising global demand for goods such as oil, natural gas and minerals. The demand for these goods is highest in emerging markets whereof particularly Asia is an important export region. More specifically, Brazil, India and China are among the most important trade partners. As a result, Chinese and Singaporean shipping lines have created direct operating lines between West-Africa and Asia.

Main ports of West-Africa

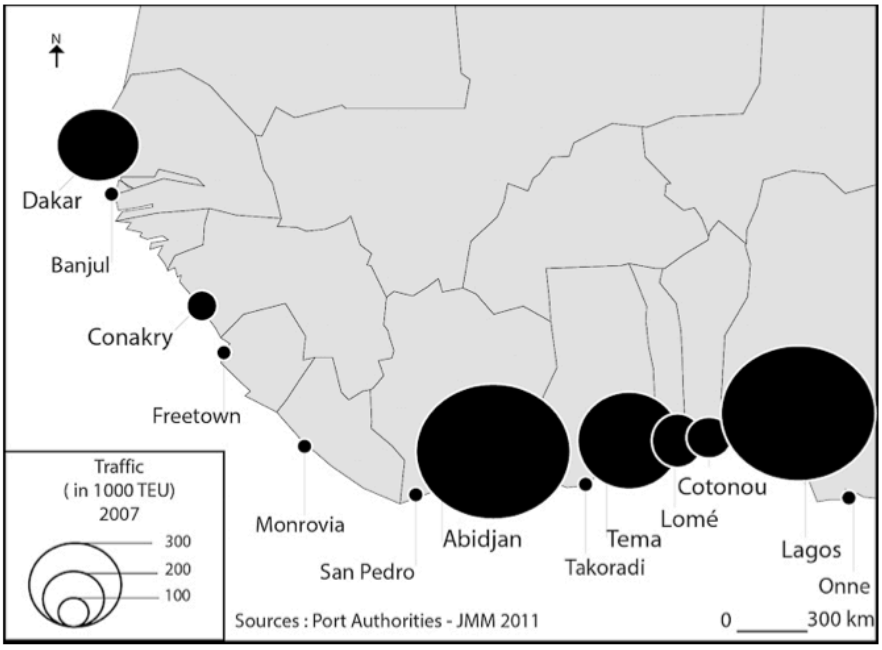
The change in which private operators invest in the development of ports is a general phenomenon, but it must be adapted to the specific context of West-Africa. To make this research more effective, there will be a focus on four specific ports in the region, namely Tema (Ghana), Abidjan (Ivory Coast), Dakar (Senegal) and Lagos (Nigeria). The reason why this focus was chosen, is mainly because these ports show the largest numbers in container traffic among all ports in the region, as can be seen in figures 3 and 4 and in table 4. Moreover, but certainly not less important, information on these ports is available, both in numbers and in English and French language. To fully understand the context in which these ports develop, in order to say something about the future organization of the network of these ports, a brief background will be given on every single port. To keep consistency, this background will involve information on the following parts: historical background, container traffic growth, assessment of numerous port selection criteria (efficiency, infrastructure and political stability) and planned development projects. An important source used for this empirical evidence is a report published by CATRAM (a maritime and logistics consultant) in 2013 who conducted a market study on container terminals in West-Africa. All this information will facilitate the discussion in chapter 4 on the future position all four ports will take in the West-African port system.

Figure 3 – Growth of containerization



Source: Containerisation international 2011 & Secafil/Yann Alix 2011.

Figure 4 – Container traffic



Source: Containerisation international, 2011.

Table 4 – Container port throughput per country

Country	2010	2011	2012	% change 2010-2011	% change 2011-2012
Ghana	647 052	683 934	889 129	5.70	30.00
Nigeria	101 007	106 764	111 035	5.70	4.00
Senegal	349 231	369 137	383 903	5.70	4.00
Ivory Coast	607 730	642 371	668 065	5.70	4.00

Source: UNCTAD

Port of Tema (Ghana)

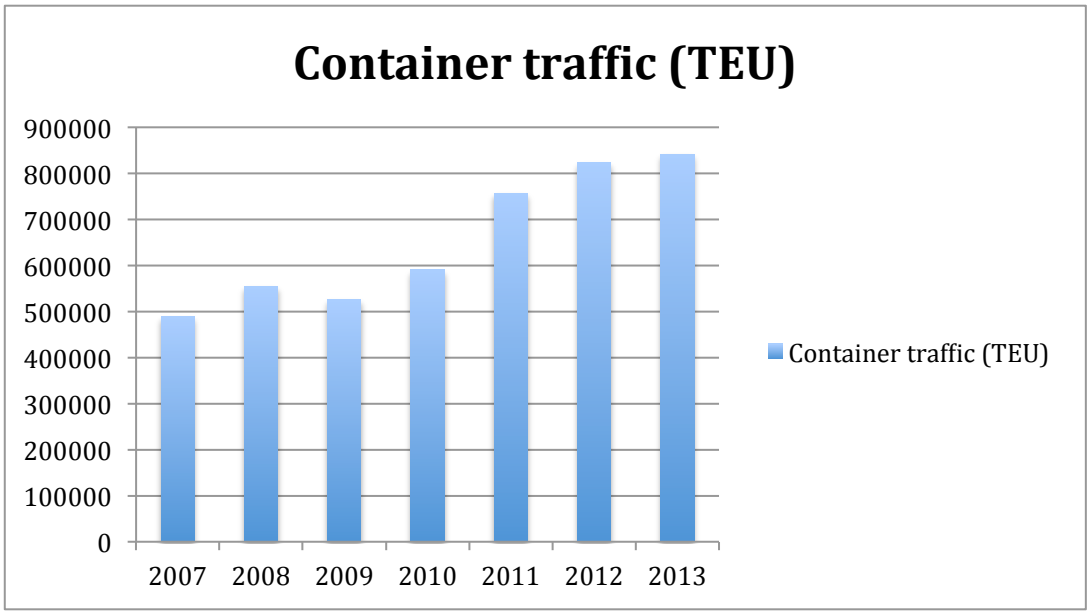
Historical background

Tema port is located on the eastern coast of Ghana, now one of the richest countries in the region that is enjoying an economic boom after the discovery of an offshore oil field (Jubilee Field) in 2007. After Africa's independence, Ghana and the city of Tema were promising in terms of prosperity. The development of Tema began in 1954 by Sir William Halcrow and some of his partners (Chalfin, 2010). Ghana is a leading producer of cacao (with Ivory Coast as their main competitor) so Tema was seen as crucial for the cacao export. Moreover, as the middle-class grew (Tema's population had grown from 3000 inhabitants in 1954 to 80,000 in the mid 1960's) Tema was important for the import of consumer goods. After 1990, the port of Tema experienced an incredible increase in port traffic, which included imports and exports as well as transit cargo to their landlocked neighboring countries Niger, Burkina Faso and Mali. By 2008, Tema passed the 500,000 TEU target originally set for 2010 and so they started developments for their future plans. The mission of the port of Tema is: "To provide efficient port facilities and quality services to our clients and regulate logistics clusters in the port." Their vision reads: "To be the leading container hub and the beacon of trade and industry in West Africa." (Ghana Ports and Harbours Authority).

Container traffic growth

In 2011, container traffic experienced a real boost with an increase of nearly 30% compared to growth of around 10-15% the years before, as can be seen in the last column of figure 5. Growth continued after this boost and is expected to do so in the coming years.

Figure 5 – Container traffic growth Port of Tema



Source: CATRAM (2013)

Efficiency

For analyzing the efficiency performance of each of the ports, a recent report on the efficiency assessment of West-African ports is conducted (Van Dyck, 2015). The assessment was conducted through a Data Envelopment Analysis (DEA) model that facilitated the provision of scores on efficiency for each port. These scores will be used in this research when it comes to efficiency. The variables used in the model are: container throughput, total quay length, terminal area, number of quayside cranes, number of yard gantry cranes and number of reach stackers. These last two variables are used because they are commonly used in West-African ports. Moreover, a window-analysis is applied in the model to capture variations in efficiency over time, which makes the model more reliable as it prevents the results from being a static snapshot. The assessment covers a period of 7 years. All scores over this period can be found in the appendix. With a score of 91%, Tema appears to be the most efficient among the four ports in its production over time (see table 5). It must be noted that Tema is the smallest port in terms of terminal area, namely 10 ha (compared to the biggest terminal Lagos, 55 ha).

Table 5 – Average efficiency score according to the DAE model

Port	Average score
Abidjan	90%
Dakar	62%
Lagos	76%
Tema	91%

Infrastructure

To analyze the infrastructure of all ports, numerous features of the ports are displayed in similar tables (see table 6 as an example for Tema) that facilitate comparison for the discussion in chapter 4.

The national port authority (Ghana Ports and Harbours Authority, GPHA) is greatly involved in the port management. It sets the general framework, regulates the operations, builds and maintains the infrastructure and sets the rates for users of the ports. Although the port of Tema is not that old, its facilities overall are quite poor. The two most crucial problems the port is facing are limited drought and lack of space. With a maximum capacity of 500 000 TUE's, there is not enough space inside the terminal for container storage. As can be observed moreover in table the port of Tema has bad external infrastructure. It has access to one road only, which is congested most of the time. Moreover, it has no access to rail. This makes connectivity to the hinterland problematic.

Table 6 – Infrastructure in the port of Tema

Feature	Tema
Operator	MPS (Bollore 35%, APMT 35%, GPHA 30%
Length of concession	20 years
Terminal size	10 ha
Inland terminals	3
Road access	Yes, only 1 and congested
Rail access	No
Maximum capacity	500 000 TEU
Crane productivity	20 moves p/h
Container handling costs	$168

The port of Tema was originally not designed to be container terminal, but for conventional traffic. As a result, the container yard is situated away from the quay which increases costs as handling time increases. At the moment, the port has introcuced temporare solutions to cope with the increase in traffic (such as extra container space outside the port), but expectations are that they cannot sustain this situation in the future if the are not able to increase container space

Political stability

Political stability is crucial to successful port business, as this determines the competitiveness of a port. When a country experiences much instability in this area, terminal operations can be frozen and ports can get difficult to reach or even inaccessible. Therefore, the political situation of the country of origin of the port is important to take into account. To analyze the ports in terms of political stability, the Peace and Conflict Instability Ledger is used, published by the Center of International Development and Conflict Management. This model is based on five different factors that deal with political instability (for full

explanation, see the report of Peace and Conflict 2012). The risk score gives a forecast of a period of three years compared to an average OECD member (for reference: The Netherlands has a score of 0.2).

The risk score for Ghana is 6.5, which is relatively low (for a complete list of all African countries, see the appendix). Also, non of the neighboring countries are in a conflict, which lowers the risk for instability in Ghana.

Projects

The Gateway Project is a project that aims to strengthen the competitive position of Ghana and ultimately, result in Ghana being a regional hub for West-Africa (The World Bank, 2013). Part of this project is the expansion of the port. Earlier this year, Meridian Port Services (MPS) signed a deal with the port authority to commence this $1.5billion project. The most important elements of the project will facilitate the receiving of larger vessels, expand the Accra-Tema motorway and increase the container handling capacity. These improvements should improve two of the main problems of the port of Tema, namely lack of space and poor and congested external infrastructure. However, the consultants of CATRAM (2013) foresee the risk that the plan is too ambitious and expensive to be realized in time.

Port of Abidjan (Ivory Coast)

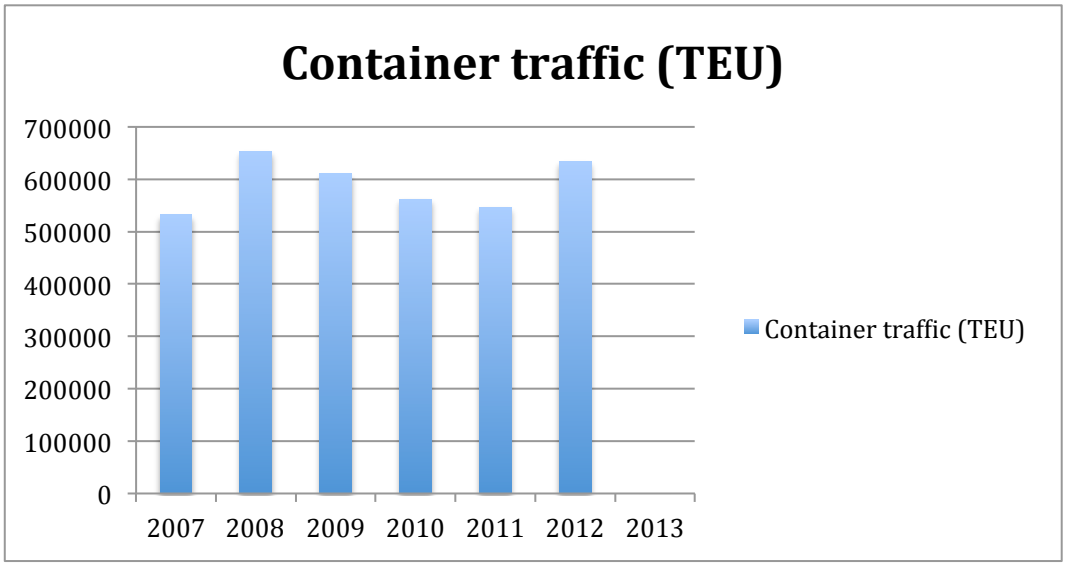
Historical background

From 1934 to 1960, Abidjan was the capital of the French colony. The French built poor port facilities. In 1950, the Vridi Canal was constructed which connected the city to the open sea. After this development, the port of Abidjan soon became the most important place for maritime and financial business of West-Africa. After independence in 1960, Yamoussoukro was named capital of Ivory Coast. Despite this, the port of Abidjan still continued to flourish. The most important productions for Abidjan are coffee, cacao, food processions and numerous manufacturing goods such as automobiles and soap (World Port Source, 2015). In 1999, the country experienced a heavy conflict after a military coup, which led the country into chaos and economic decline (United Nations, 2004). This chaos lasted until 2001. In 2002, the first civil war started, that ended in 2007. A second civil war aggravated the country from the end of 2010 until mid 2011. Abidjan serves the landlocked countries Mali and Burkina Faso. However, during the period of conflict, the port of Abidjan was abandoned by almost all maritime services. As a result, hinterland transport to landlocked countries had to be done via other routes and ports, which lost the port of Abidjan significant transit traffic opportunities (mostly to the ports of Dakar and Tema). Despite all the recent turmoil, Ivory Coast's political stability seems decent at the moment and for the future (Van Dyck & Ismael, 2015).

Container traffic growth

The container traffic experienced a significant decline during the conflict of the second civil war of 2010-2011, as can clearly be seen in figure 6. This was due to the fact that the port was abandoned and there were fundamentally no operations. However, in 2012 there was a large recovery, which is a positive sign for the competitiveness of the port. *Note: no reliable data could be found for 2013.*

Figure 6 – Container traffic growth Port of Abidjan



Source: CATRAM (2013)

Efficiency

With a score of 90%, the port of Abidjan ends as the second most efficient port (see table 7). Important is to notice that this differs only 1 percentage point with Tema, which makes the two ports nearly equal in efficiency. Also, the efficiency results of Abidjan remain most stable over time compared to the other three ports, as can be seen in the window-analysis results in the appendix. This efficiency stabilization is valuable to Abidjan, as it makes the port reliable. It must be noted that the tariffs of Abidjan are among the highest of all four ports.

Table 7 – Average efficiency score according to the DAE model

Port	Average score
Abidjan	90%
Dakar	62%
Lagos	76%
Tema	91%

Infrastructure

The port of Abidjan has both road and rail access, which facilitates external infrastructure (see table 8). However, the road does need upgrading as there is congestion in the port area, which makes access to the container terminal from the road difficult. The railway connects Abidjan to Burkina Faso, one of the landlocked countries served by Abidjan. The presence of numerous inland terminals creates enough space that can be used as storage sites. This makes it possible for the port to focus on port handling operations and efficiency. With a maximum capacity of 1.3 million TEU's, Abidjan has possibilites for further growth. Abidjan does have the highest container handling costs, however in cominatino with one of the highest efficiencies.

Table 8 – Infrastructure in the port of Abidjan

Feature	Abidjan
Operator	SETV (Bollore 60%, APMT 40%)
Length of concession	15 years
Terminal size	34 ha
Inland terminals	7
Road access	Yes, congestion in port area
Rail access	SITARAIL, 2-3 trains per week
Maximum capacity	1.3m TEU
Crane productivity	18 moves p/h
Container handling costs	$260

Political stability

Despite of all the conflicts the country has dealt with in recent years, Ivory Coast today ends up with a score of 7.7 in the Peace and Conflict Instability Ledger. This is relatively good, compared to other countries in Africa. However, the ledger does categorize Ivory Coast as a country with a moderate risk for future political instability. Therefore, Ivory Coast remains a country with a certain risk for political instability that must not be neglected.

Projects

A deal for a project for the expansion of the port of Abidjan was signed last year. This project deals with the construction of a second container terminal, that will expand the port's capacity to 2.25million TEU, which would make it the largest in West-Africa. This project includes the widening and deepening of the Vridi Canal, which is at the moment a limiting factor to the development of the port as it does not allow the new, largest vessels. The construction of the second terminal will be beneficial for the tariffs of the port, which are among the highest of the four at the moment.

Port of Dakar (Senegal)

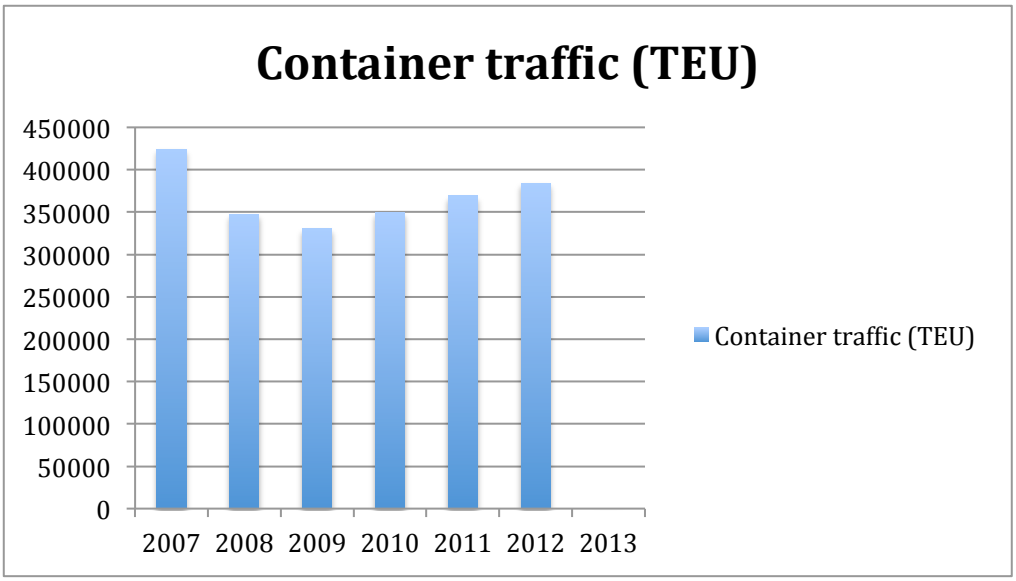
Historical background

Dakar is situated at the most western point of Africa. Construction of the port began in 1857 by the French, who colonized the country at the time. The French governor made the Imperial freight-forwarders sign an agreement that ordered them to stop in Dakar on their way to Brazil. As a result, the port had more incentive to increase its efficiency and quality of operations. In the 1880's, a railroad was built that connected Dakar to the capital of the French Colony. This resulted in Dakar gaining more importance in the West-African region colonized by the French, and so Dakar began to grow as a city (World Port Source, 2015). In the beginning of the 19th century, Dakar moreover became the capital of French West-Africa and the road en railway network around Dakar was further developed. At that time, Dakar's most important industry was peanut production. Since World War II the port of Dakar started to grow significantly with many expansion projects that were being executed. However, in 1961 the French Colony was divided into 8 independent states, which resulted in decreasing power of Dakar and a reduction of its market. In 1987, the Port Autonome de Dakar (the port authority of Dakar) was established as a national company to create more efficiency by better integrating all the different operations running in the port. In 2007, a concession with DP World was signed. In 2011, the new container terminal began operations and significantly increased the original capacity of the terminal.

Container traffic growth

Growth of container traffic significantly declined in the year 2008, most probably because of the global financial crisis. In the year before (2007), the container terminals came in the hands of DP World. From 2009 onwards, increase in the container traffic was present again. However, the traffic numbers of the year 2007 have not yet been reached since, as can be seen in figure 7. Transit traffic has increased significantly since 2009. This is mainly due to the crisis in Ivory Coast, which gave the port of Dakar the opportunity to capture the transit traffic of Abidjan to Mali. *Note: no reliable data could be found for 2013.*

Figure 7 – Container traffic growth Port of Dakar



Source: CATRAM (2013)

Efficiency

Despite of the fact that DP World (known for its efficiency) operated the terminal, Dakar at the moment still has the lowest efficiency score of all four ports, resulting in a score of 62% (see table 9).

Table 9 – Average efficiency score according to the DAE model

Port	Average score
Abidjan	90%
Dakar	62%
Lagos	76%
Tema	91%

Infrastructure

The size of the terminal is comparable to that of Abidjan (see table 10). Dakar has 4 inland terminals that are used for the processing of containers. The inland terminals have limited space and in combination with a lack of standard processing, the efficiency is relatively low. There is access to both road and rail. The road is congested at exit points of the terminal and the road infrastructure to Mali has worsened throughout the years due to an overkill of trucks. Rail access is present, however inefficient. The terminal has modern facilities and equipments, since DP World invested heavily in this. As a result, productivity is annually increasing. Crane productivity is among the higest of the four, with an average of 20 movements an hour.

Table 10 – Infrastructure in the port of Dakar

Feature	Dakar
Operator	DP World
Length of concession	25 years
Terminal size	35 ha
Inland terminals	4
Road access	Yes, congestion at exit points of port
Rail access	Yes, Senegal - Mali
Maximum capacity	700 000
Crane productivity	20 moves p/h
Container handling costs	$160

Political stability

Senegal ends up with a score of 8.0 in the Peace and Conflict Instability Ledger, which makes it the second in rank of the four ports. However, the difference with first in rank Nigeria (port of Lagos) is 12.7, whilst the difference with third in rank (Ivory Coast) is only 0.3. This slight difference has to do with the fact that the predictions for Ivory Coast are more confident compared to the predictions for Senegal. Still, Senegal is among the more stable countries in Africa.

Projects

The main project for the port of Dakar is called 'Port du Futur' and was signed during the awarding of the concession to DP World. The main goal of the project is to attract more transhipment from traffic that takes place between America and Asia. The project will start only when container traffic has reached 412 500 TEU's. The project will enlarge the capacity of the terminal to 1.5 million TEU's.

Port of Lagos (Nigeria)

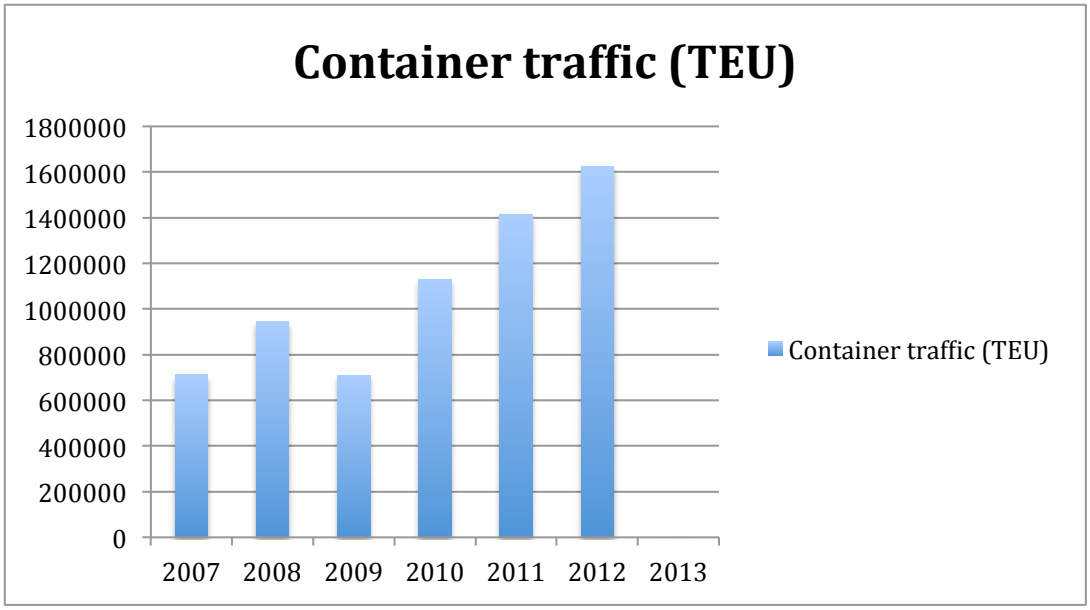
Historical background

Port development and operations in Lagos began in the middle of the 19th century. In 1954, the Nigerian Port Authority was established to implement a consistent policy framework (Nigerian Ports Authority, 2014). From 1967 – 1970, Nigeria was hit by a civil war that had a huge negative impact on port operations, as the port was closed for foreign traffic. After the war, a large development plan was executed to rehabilitate the port and the national economy from the civil war. From 2003 onwards, the port has strongly been working on improving its efficiency by giving rise to many concessions. For Nigeria, oil and natural gas are the most important export products. The lack of diversifications was a big challenge for Nigeria, as it made their economy vulnerable. However, nowadays Nigeria is trying to seek ways to diversify its economy.

Container traffic growth

Lagos by far has the largest container traffic volumes of the four ports, due to the fact that the Nigerian economy is the largest in West-Africa. Their volumes can be seen in figure 8. The majority of this traffic is likewise meant for the domestic market. In 2009, the port of Lagos too experienced a decline in container traffic due to the financial crisis. *Note: no reliable data could be found for 2013.*

Figure 8 – Container traffic growth Port of Lagos



Source: CATRAM (2013)

Efficiency

Lagos ranks third when it comes to efficiency, with a score of 76% (see table 11). The port has the lowest container handling costs ($155) but the lowest crane productivity. This has negative effects on the efficiency gained. This result also triggers the thought that the larger the container terminal size, the more difficult it gets to gain efficiency.

Table 11 – Average efficiency score according to the DAE model

Port	Average score
Abidjan	90%
Dakar	62%
Lagos	76%
Tema	91%

Infrastructure

Lagos is by far the largest port of the four, with a terminal size of 55 ha (see table 12). The port of Lagos has the lowest water depth (9m) compared to the other ports. Consequentely, they cannot conceive the larger vessels. They loose these port calls to the port of Abidjan, who has the largest water depth (15m). They only have road access. This road transport however is not advantegous, as the distance to landlocked countries is great (Van Dyck, 2015). Also, the road is in poor conditions due to an overload of trucks and congested near the port entrance. The rail service is also in poor condition and does not provide transport to neighboring countries. Recently, the port announced the consturction of a new rail service that will take substitute the road service that currently transports containers out of the port (Nigerian Daily News, 2015). This should result in less congestion inside the port.

Table 12 – Infrastructure in the port of Lagos

Feature	Lagos
Operator	APMT, Bollore, Grimaldi
Length of concession	25 years, 15 years, 25 years
Terminal size	55 ha
Inland terminals	7
Road access	Yes
Rail access	Yes, only within Nigeria
Maximum capacity	2.2m TEU
Crane productivity	15 moves p/h
Container handling costs	$155

Political stability

With a score of 20.7, Nigeria scores highest of all four regions when it comes to political stability and even 8th in the ranking of all 163 countries present in the ledger. Nigeria clearly has some serious problems when it comes to this subject. Next to their overall score, Nigeria appears 14th in the rank of countries with the highest risk for genocide (violence against and/or execution of groups of people based on their communal characteristics) or politicide (violence against and/or execution of groups of people based on their political preference). The two major reasons for Nigeria to end up in this position are the presence of Boko Haram (a jihadist group) and the high level of political corruption.

Projects

Lekki Port project

In may 2015, the construction of a new seaport in Lagos has begun. The new seaport at Lekki should start operations in 2018. By then, it should be the largest seaport in Nigeria with an initial depth of 14 meters with potential further dredging to 16.5 meters (Lekki Port, 2014). One of the main objectives of the project

is to ease congestion in the port. The port will host a container terminal, a dry bulk container and a liquid bulk container, making it a multi-purpose port.

Badagry Deep Sea Port

Just after the start of the Lekki Port project, the government of Lagos announced the construction of another port: the Badagry Port (Construction Review Online). This port is a deep sea port that, when finished, should be the largest deep-sea port in Africa. Already numerous investors, among others Maersk Group and APM Terminals, have shown their interest in the project.

Chapter 4 – Future port hierarchy in West-Africa

Table 13 summarizes the findings of chapter 3. This table creates an overview that will facilitate the discussion in this chapter on the future development of the hierarchal port system in West-Africa.

Table 13 – Overview findings chapter 3

Criteria/**Ports**	**Tema**	**Abidjan**	**Dakar**	**Lagos**
Container traffic	> 800 000	> 600 000 TEU	> 350 000 TEU	> 1.5m TEU
Efficiency	Very good	Very good	Poor	Sufficient
Infrastructure	Poor, bad hinterland connectivity. No rail access. Not able to receive largest vessels.	Good, however congested areas in the port. Presence of rail service to hinterland.	Sufficient, presence of both road and rail access. However, both of poor quality. Presence of modern facilities inside the terminal.	Very large terminal capacity, however not able to receive largest vessels yet. Both road en rail access, however in poor condition.
Political stability	Good	Good, however moderate risk	Good	Bad
Location/ Hinterland	Strategic location with respect to hinterland, least distance.	Strategic location with respect to hinterland.	No strategic location with respect to the hinterland, largest distance.	Strategic location with respect to hinterland. High connectivity to global shipping network.
Potential port classification (as a result of projects)	*Regional port*	*Global pivot*	*Regional port*	*Global pivot*

West-Africa is developing very fast with increasing growth of GDP and domestic demand, which in turn increases container traffic. Shipping lines that call at West-Africa have multiple ports they can choose from. However, one dominant hub port lacks in the region. In the past, the West-African market was not suitable for having a regional hub port because of insufficient container traffic and poor performing ports. The general problem that existed in West-Africa as to why they were not able to join the global competition, was their lack of efficiency and non-competitive prices. This is why today it still belongs to the peripheral region within the global port network, with most West-African ports still begin classified as feeder ports (African Development Bank, 2010). The lack of a regional hub maintains the high tariffs that ports charge, as they cannot enjoy economies of scale due to insufficient traffic volumes. If a regional hub exists, this will attract more container traffic, which enables the ports to make use of economies of scale and hence, lower their charges. Moreover, the attraction of international shipping liner companies and

terminal operators will also lower prices, due to their knowledge and experience that can be applied in efficient port operations. Today, because of the rapid development of West-Africa, the market is suitable for hosting a regional hub port. The ports in the region have started to anticipate to this knowledge and competition is increasing. All ports want to attain the status of regional hub port of West-Africa, particularly Tema, Abidjan, Dakar and Lagos, which will have a multiplier effect on the country's economy as it will receive port calls of the biggest vessels in the world. However, there are significant differences between these four ports that alter their chances to potentially become the region's hub port.

One important requirement for a port to become a regional hub is the attraction of sufficient container traffic volumes. Based on chapter 3, Lagos by far has the largest numbers in terms of container traffic. This also follows from the fact that Lagos is the largest port in terminal size. Tema and Abidjan follow second and third in container traffic. The main difference between the two largest ports (in terminal size) is the depth of the draft. With a depth of 15m, Abidjan can receive bigger vessels than Lagos (that has a draft of only 9m at the moment). All ports realize that expanding their capacity is a must for being able to handle the vessels of ever-increasing size and the growing container traffic that comes with being a regional hub and so, competition is fiercer than ever. Consequently, all projects that are planned have an objective concerning the expansion of the port. With the current projects, Abidjan and Lagos should come out as the largest port in terms of capacity when the projects are finished. As a result, port concentration will exist within these ports, a phenomenon that generally precedes the rise of a hub port. Lagos is still expected to have the largest container traffic volumes and with the construction of the Badagry Port, it should also be able to receive the large vessels it currently looses to Abidjan. One important factor that hinders Lagos from becoming a regional hub is the fact that the majority of its cargo is destined only to its national market. Lagos also serves some outlying parts of Niger, but furthermore it does not serve the landlocked countries of Mali and Burkina Faso. A port must have sufficient hinterland traffic in the region to actually become a regional hub, but this is not the case for Lagos. In terms of hinterland service, Abidjan and Tema are the largest providers of this transit service, which gives them a competitive advantage in becoming the regional hub port.

But investing in capacity is not the sole key to becoming a hub port. As the literature review in chapter 2 shows, efficiency is a crucial element when it comes to port choice. The level of port charges in combination with the quality of service determines the port's efficiency and hence, its competitiveness. Tema and Abidjan both score highest in terms of efficiency. Abidjan charges higher tariffs than Tema, in fact the highest of all four ports. However, the infrastructure (both internally and externally) in the port of Abidjan is better than that of Tema (and all other ports), which justifies the higher port charges.

Infrastructure is another criterion that is considered essential by shippers when choosing their port of call, which makes Abidjan preferable to Tema.

Despite all the progress West-Africa is making, political instability is an important characteristic of the region that still has major negative influence on port development and hence must not be neglected when classifying the ports. Because of this factor, the development of the port network in West-Africa cannot simply be compared to that of developed regions, such as Europe. Another consequence of this feature to keep in mind is that foreign investors (who are much needed) can become reluctant to investing heavily in one port, as there is always a risk that the region of the port gets involved in a conflict and consequently, makes the port inaccessible and inactive. This still existing risk slows and hampers the development of a dominant regional hub (Debrie, 2012). When analyzing the political environment of all ports, Tema appears to have the most stable political situation. The difference with the second and third best, Abidjan and Dakar respectively, is relatively small. It can be concluded that the political environment of these three ports is favorable as well in becoming a hub port. Lagos on the other hand stands out very negatively when it comes to a stable political environment, with a score of 20.7. This is another criterion that significantly lowers Lagos' chances in becoming a regional hub.

The location of a port is another criterion from chapter 2 that matters when desiring the status of hub port. Location is analyzed based on its position along the major shipping routes and its position relative to the hinterland market. The hinterland market for these four ports are the landlocked countries Niger, Mali and Burkina Faso. The port of Tema has the least distance to the hinterland, whilst Dakar (at the most western point of the region) has the largest distance to the same hinterland. Tema thus seems to have the most favorable location for hinterland transport service. In terms of connection to the global shipping routers, Lagos has the highest connectivity (as a result from their high container traffic volumes), followed by Tema and Abidjan (where the difference in connectivity is marginal). Overall, Tema and Abidjan seem to have the most optimal location with regard to both the global shipping routes and the hinterland. When weighing these two ports in this consideration, the factor that makes Abidjan preferable to Tema is their capacity. Tema is experiencing a lack of space, which makes the handling of increased container traffic (including transit traffic to the hinterland) problematic.

In response to the increasing container traffic to West-Africa, all four ports have initiated projects that are mostly aimed at increasing efficiency and handling capacity, both in terms of container volumes and size of vessels. Of all projects, those of Abidjan and Lagos seem the most promising in achieving these objectives. For Lagos, already the largest port in the region, the potential of receiving larger vessels is a

critical necessity. For Abidjan, the expansion of the port is more important. As for the other two ports, Dakar is planning on increasing their terminal capacity. However, they critically need projects that improve their rail and road service as well. For Tema, next to increasing their draft depth, the development of their external infrastructure is an advancement that will benefit them in today's changing maritime business.

When considering all criteria that are crucial for a port to potentially become a hub port, Abidjan seems to have the most favorable position at the moment and hence, the best chances. The combination of high efficiency, large capacity, ability to receive the largest vessels, strategic location and a stable political environment (in comparison to the other ports studied) make it the most competitive port and therefore, a desirable location for West-Africa's hub port. Nevertheless, it must be noticed that despite the critical problems present, Lagos is also promising in the competition. One of the major problems the port faces is their political instable environment, which makes the investment climate unattractive. Moreover, what is interesting is that Nigeria claims they are still being disadvantaged by a report that was published by the World Bank in the late 1990's that did not favor Lagos in becoming a hub port (This Day Live, 2012). This could be valid, noticing how often Lagos is not favored as hub port in the existing literature. However, change is underway. Earlier this year, Nigeria elected a new president: Muhammadu Buhari. One of his top-list to do's fighting Boko Haram. There are several reasons to believe he will be successful, among others the fact that Boko Haram is already on weaker foot and the fact that President Buhari is a man with a military past, which will reasonably extort him respect and cooperation from the armed forces (The Guardian, 2015). Moreover, the president claims that he is a real democrat and will bring democracy to Nigeria. Although in politics you can never be sure about this, and particularly not in developing countries, the political environment for Nigeria will improve greatly once the presidents keeps his promise. If he succeeds, in combination with the expansion projects running momentarily in the port, Lagos can be highly attractive for the status of hub port as well. This could be concluded considering the existing benefits of (among others) the largest container traffic volumes and the largest economy of West-Africa. Moreover, the fact that the Lekki Port will be a multi-purpose gives them a significant competitive advantage. The other ports have general storage and warehousing facilities, but no special dry and liquid bulk terminals.

Overall, in case Abidjan will become the regional hub port, and therefore a potential global pivot within the global maritime transport network in the future, the other ports will also change in classification. As seen from the desk research in chapter 3, the other three ports will ordinarily continue to grow in terms of container traffic in the coming years. Lagos already has container traffic volumes that exceed 1 million

TEU's annually. Tema is expected to exceed 1 million TEU's as well in the coming years, looking at their current volume, growing rates and expansion projects. Therefore, Lagos and Tema will most probably be classified as load centres. Dakar on the other hand is not expected to exceed the 1 million TEU's in the near future, hence, according to the classification characteristics of table 1 in chapter 2 (p. 6), will be a regional port.

Chapter 5 – Conclusion

This thesis has examined the future of the port network in West-Africa, a now peripheral region that is developing fast. An important reason for the staying behind of West-African ports on the world stage is the lack of the ports' efficiency and competitive port charges. Where most ports were state-owned in the past, nowadays many private foreign investors in the form of shipping lines and container terminals are present in the ports and consequently, influence its development. Their presence facilitates the increase of both efficiency and competitive prices. This knowledge is also recognized by the ports and their authorities, who anticipate to this matter by setting up numerous development projects which in turn, change the landscape of the existing port network. In order to predict the development of this network and therewith, the new classifications of the four focus ports in this region (Tema, Abidjan, Dakar and Lagos), a number of port-selection criteria were defined from existing literature and research. These criteria determine on which grounds shipping lines and freight-forwarder (the main port users) choose their port of call. The most important criteria that were used in the research are container traffic volumes, efficiency, infrastructure, political instability and location (mainly with respect to hinterland). Moreover, development projects that are planned for the ports in question were taken into account as well, as these projects alter the ports' future capabilities. One factor that specially characterizes the region of West-Africa is the level of political instability. This feature has significant influence on the investment climate where the ports are established and hence, play a crucial role in the outcome of the research. Concluding, the port of Abidjan seems the most probable to become West-Africa's future hub port, due to its high efficiency, large capacity, ability to receive the largest vessels, strategic location and a stable political environment. Nonetheless, special attention must be kept on the development of Lagos. In terms of container traffic volumes and capacity, they are highly competitive and desirable for becoming a hub port. Moreover, the construction of Lekki Port also makes them an interesting future candidate. The Lekki Port will be a multi-purpose port, including a container terminal, a dry bulk terminal and a liquid terminal. This will create many high standard facilities that their clients can use and hence, create a complete service. However, at the moment Nigeria (where Lagos is situated) is still facing challenges that seriously harm their chances. The most important challenge is their political instable environment, with the presence of Boko Haram and the high level of political corruption. Though, with the recent election of the new president Buhari, crucial change might be underway. Yet, Abidjan stays favorite at the moment.

Recommendations for further research include studying the West-African port development from an external, global perspective. The global maritime network knows some major maritime routes that connect the most important ports and regions, which results in certain centres of gravity within this network. The implications of the rise of the West-African ports on these global routes and consequently, centres of

gravity can be a subject of further research. Another recommendation covers the comparison of the development characteristics of the West-African ports to the development characteristics of the ports in the rest of Africa in order to examine if and why certain similarities and differences exist.

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Appendix A – Average port efficiency through window (DEA model)

Ports	2006-2007-2008-2009	2007-2008-2009-2010	2008-2009-2010-2011	2009-2010-2011-2012
Port of Tema	0.96	0.94	0.87	0.87
Port of Abidjan	0.88	0.90	0.91	0.92
Port of Dakar	0.72	0.68	0.56	0.53
Lagos Port Complex (Apapa)	0.78	0.78	0.74	0.75

Appendix B – The Peace and Conflict Instability Ledger for Africa