

DERIVING PRAGMATIC EXPERIENCES FROM CHINA PORTS THAT ARE CENTRAL IN BUILDING CAPACITY TO ATTRACT MEGA VESSELS: THE CASE OF DURBAN PORT

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ABSTRACT

One major development in the maritime industry has been the consistent growth of container vessel size over the past 40 years. The rationale being underpinned by the need to generate cost savings for carriers and decrease maritime transport costs. Whilst vessel size has been increasing on a yearly basis, there has however been a mismatch between port capacity and the growth of container vessels calling at ports. In order to respond to this problem best, the paper employed a qualitative study design in nature, and was complemented by a case study method. The method supported the paper in terms of assessing three ports from China that have developed capacity to handle mega vessels. The ultimate aim of this assessment was to use the theoretical framework of China ports as a basis for the development of a conceptual framework for Durban port. The paper concluded by empirically affirming that reforms that were undertaken at China ports in a form of governance and operational systems have the potential to increase productivity and create adaptive capacity for Durban port to attract mega vessels. It further presented that the conceptual framework, should be responsive to the current realities of Durban port and its geographical location, especially since the port serves as a gateway to the Southern African region.

KEY WORDS: Container vessel, Mega vessels, port capacity, China Ports and Durban Port

1. INTRODUCTION

Since the 1920s various forms and sizes of container vessels have been configured with a view to increase carrying capacity (Harrison, Figliozzi and Walton, 2000). During the 1960s container vessels carrying capacity was at 1000 TEU's, however by the 1990s the figure grew to 4,500 TEU's (ibid). By 2004, positive developments in the maritime industry brought about container vessels that could carry over 8,000 TEU's (Corbett and

Winebrake, 2008). Ten years later, according to Tirschwell (2014), the average size of a container vessel was approximately 8,000 TEU's, as container vessel sizes had increased to a maximum of 14,000 TEU's. Currently, empirical evidence demonstrates that the largest container vessel can carry 19,200 containers; whilst by 2017 mega container vessels will carry more that, 21,000 TEU's (Merk, Busquet and Aronietis, 2016). Key to note is that the growth trend has been in favour of larger vessels since 2004, increasing from 1% of the containership fleet at the beginning of 2008 to more than 12% by 2015, and is still increasing (Penfold, 2015). The below figure, provides the evolution of container vessel size.

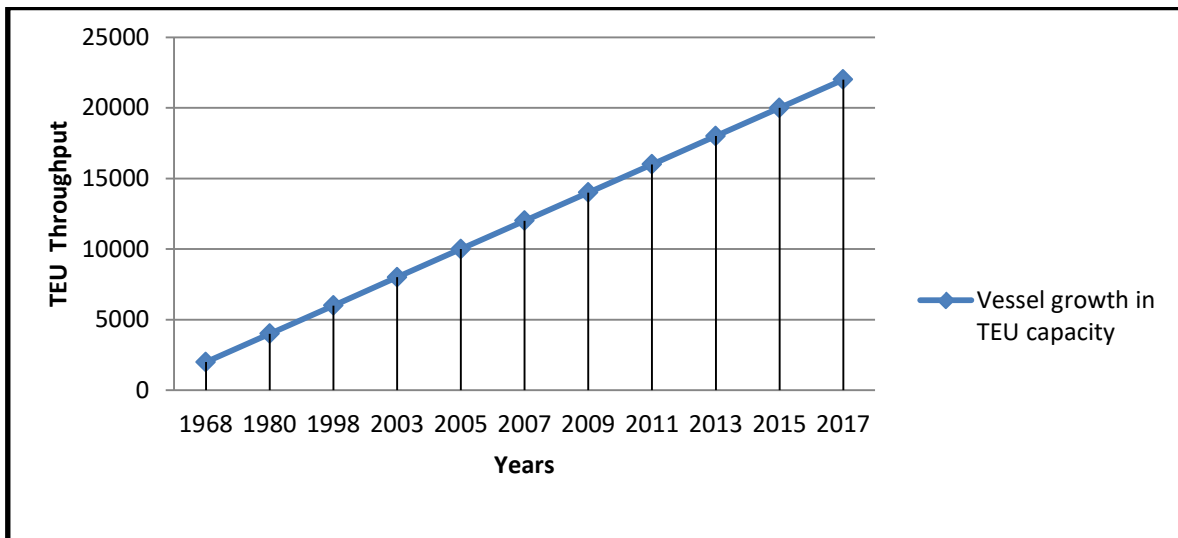


Figure 1: The evolution of global container vessels as of (1968-2017)
Source: Organization for Economic Co-operation and Development: OECD (2015)

It is apparent from figure 1 that containership size has been experiencing consistent growth over the past 40 years. Thus, meaning what was considered to be mega 10 years ago cannot be considered mega today. Therefore, the need to define the scope of a mega container vessel in this paper becomes even more essential. Merk, Busquet and Aronietis, (2016) indicate that there are different ways to measure container vessels, such as the length and the maximum TEU capacity that the ship is able to carry. In this paper the method that will be used to measure container vessels is based on TEU capacity. The justification is underpinned by the fact that most container ports that will be assessed in this paper capture data in TEU. Secondly, the paper focuses on container vessels and such data is generally captured in TEU's.

In light of the above, this paper will therefore consider a container vessel to be mega, if it has the capacity to carry more than 13, 000 TEU's. This definition is informed by what leading shipping liners such as Maersk, China Shipping and MSC consider to be mega (Merk, Busquet and Aronietis, 2016). Such a view is also affirmed by the (OECD, 2015) that any vessel with a capacity of 13, 000 can be considered mega. It is also important to note, that the term mega vessels has evolved with time and place. According to the OECD (2015) mega-vessels have become longer than four soccer fields, with shipping lines announcing monthly orders of bigger vessels. Much of the justification for vessel size increase has been driven by container shipping lines in search for economies of scale. The

increase in vessel capacity has further contributed towards improved containerised trade (Malchow, 2015). Even with the evidence that container vessels have been increasing in size on a yearly basis. Reality on the ground demonstrates a mismatch between port capacity and the growth of container vessels calling at ports (OECD, 2015).

It is against such a backdrop that this paper focuses on the need to create port capacity that will be responsive to the ascendancy of mega vessels at Durban port. In this paper we assess key steps that should be undertaken towards realising such a feat. The steps will be informed by the experiences of a sample of Chinese ports which will be assessed. The notion is to adjust the experiences of Chinese ports for the South African context and ultimately propose a conceptual framework for Durban port. The conceptual framework will be underpinned by the theoretical framework which is based on the experiences of Chinese ports and the current requirements of Durban port. This particular approach is supported by Leshem and Trafford (2007) that reviewing literature and research experiences leads to a delineation of the conceptual framework of the study. This approach will form the underlying basis towards assisting Durban port to improve its capacity and effectiveness to handle container mega vessels, in light of the rapid increase of mega vessels in the global maritime industry.

2. STUDY DESIGN

The paper employs a qualitative study design in nature, in a form of literature assessment and case studies. According to (Cassell, Buehring, et al., 2005) qualitative research is characterised by an interpretative paradigm, which emphasises experiences in different areas. This paper will investigate some literature for purposes of understanding the different experiences of selected Chinese ports, with a view to proposing interventions that can perhaps assist Durban port to respond to the increase in mega vessels traffic. To achieve this feat, a complementary method in a form of case study to support the qualitative design will be undertaken. According to (Starman, 2013) a case study is more qualitative than quantitative in nature as it allows for further investigation on the subject matter. The Durban port case will be explored focusing on current operational modalities of the port and how they can be aligned to the ascendancy and evolution of mega container vessels.

3. JUSTIFICATION FOR THE SELECTED SCOPE OF CHINA PORTS

This section articulated the justification for selecting the three ports in China. The literature review focused on the top three performing ports in China over the past decade in terms of container throughput growth and also the average vessel size handled. The ports are Shanghai, Ningbo and Qingdao. The below figure 2 seeks to underpin the reason for selecting the said ports, by firstly, looking into vessels capacity at the selected port.

Table 1: Vessel capacity/size in the selected China Ports

Name of the port	Average Vessel Capacity in 2014	Average size of vessels to be handled in 2017
Shanghai	13,200 TEU	(> 18,000 TEU)
Ningbo	13,300 TEU	(> 18,000 TEU)
Qingdao	13,200 TEU	(>18,000 TEU)

Source OECD (2015)

The above figure indicates that the selected port on average handled vessels above the 13,000 capacity. Whilst the historical data is limited to 2014, there are projections provided by the OECD (2015) which seek to enhance the limited historical data. It is apparent that by 2017 most of these ports will be servicing at least one ship with TEU capacity greater than 18,000 every day. It can be presented that currently most of the ports are handling vessels over 13,000 TEU on a daily basis, which is considered to be mega. The data provided seems to also affirm the perspective that the definition for mega vessels will also evolve based on global developments. In essence what is considered to be mega in this paper will no longer be relevant post 2018.

Table 2: TEU – ranking of top 5 China container ports in 2015

Global Ranking		China Ports	Mill TEU			TEU % Growth between	TEU % Growth between
2015	2005		2005	2014	2015	2014-2015	2005-2015
1	3	Shanghai	14.0	35.3	36.5	3.5	10.0
3	4	Shenzhen	13.7	24.0	24.1	0.5	5.9
4	14	Ningbo	4.0	19.5	20.6	6.1	17.8
5	2	Hong Kong	22.0	22.2	20.1	-9.7	-0.9
7	13	Qingdao	5.1	16.6	17.3	4.2	12.9

Source: Institute of Shipping Economics and Logistics (2016)

The above figure depicts that the selected ports are not chronologically ranked in the top three in China. It is however from a throughput growth orientation, that they have been the top three performing ports over the past decade. They have been able to achieve consistent growth and even outperform other highly ranked ports. The selected ports have been able to achieve TEU growth levels of over 10% between 2005-2015 whereas other ports have been regressing during the same period. In essence, the selected ports serve as a paragon of success especially when considering their position in 2005 and their growth levels post the period.

4. LITERATURE REVIEW

The literature review unpacks key reforms that have been undertaken by China ports to build capacity for purposes of handling mega vessels. The reforms can be classified into two categories namely port governance and operational reforms. Whilst the reforms that relate to governance where applicable to all China ports, the focus was on the selected sample

4.1 Governance Reforms

The governance reforms are clearly discussed in the context of how they enhanced efficiency and created adaptive capacity at the selected China ports. The reforms that were assessed in terms of port governance, focused on the Institutional framework of China ports for purposes of modernising the port industry.

Institutional reform of ownership

According to (Cullinane and Wang, 2007) Chinese national reforms and the transfer of power from the central government to local governments had an impact on the governance of seaports and accommodating the private investors to contribute to the development of capacity at ports. Qui (2008) further appends that since China radically reformed its seaports from 2000- 2005, efficiency at ports like Shanghai, Ningbo and Guangzhou increased with a growth rate between 80%- 84% since 2000. Both studies reflected that the new regime enhanced participation with the private sector and local municipality at ports. The studies correlated with earlier views that the step undertaken to transfer decision making from central government to local government had a positive impact in terms of improving carrying capacity and functions that relate to planning and regulation at port such as Shanghai, Nigbo, Hong Kong and Qingdao (Lin, 2004). Notteboom and Yang (2016) conclude by indicating that the institutional reform can be attributed to the following phases: Firstly, gradual shifting of power from central government and allowing local government with private entities, including investors to invest and secondly, ensuring that the port governance landscape offers more space for private sector participation.

4.2 Operational Reforms

Operational reforms to modernise China ports are discussed below. The operational reforms were mainly in relation to improving the efficiency of container terminal subsystems. Container subsystems can be defined as those operational features that are undertaken to enable flow of containers through a port terminal and include yard facilities, handling equipment and storage facilities that support the efficiency of the port (Yang and Shen, 2013). According to Tu-Chang (1992), Koh and Ng (1994) and Esmer (2008), terminal efficiency underpins the performance of the port, which is about getting the ships in and out of ports as quickly as possible. Mongelluzzo (2014) argues that when terminals are efficient, ports are able to also handle and service bigger vessels at a higher rate. The operational reforms are discussed in the context of each port.

A) Shanghai Port

Shanghai is also China's largest port and one of the country's most important gateways for foreign trade and it's located in eastern region. Research from Cullinane and Wang (2007) and Shanghai international Port Group (2014) reveal that the expansion of the port in areas pertaining to berth areas such as length and number underpinned the creation capacity to accommodate mega vessels. The authors indicate that the port received great attention in terms of berth operations and increased its capacity from 1998 -2013 by over 60%. The same commentators also reflect that gantry cranes increased by over 80% in the same period. The additional cranes brought about additional efficiency due to their ability to handle greater capacity of containers in a single move. Notteboom and Yang (2016) also support the previous assertion by indicating that Shanghai port managed to accommodate bigger vessels after increasing berth length from 2005-2015.

B) Ningbo Port

With respect to the port of Ningbo, the steps to enhance capacity are associated with additional increase of berth facilities (Qui, 2008). This view resonates with those of Cullinane and Wang (2007) that increasing berth productivity at the port of Ningbo resulted in the port being capable of servicing larger vessels. The study also further reflected on strides that were undertaken in terms of increasing yard capacity to cater for mega vessels. According to Svendsen and Tiedemann (2006) the Ningbo port also increased its super post-panamax gantries to accommodate the ascendancy of mega vessels and further designed the 85-hectare stacking yard to accommodate the volume of containers from larger ships.

C) Qingdao

The Port of Qingdao is arguably the most important port in Northern China. According to Cullinane and Wang (2007), the port had made strides in terms of increasing berth depth to accommodate bigger vessels. Nightingale (2016) appends by indicating that the port increased berth facilities capacity by 20% at different terminals operating at the port for purposes of improving port efficiency and also to accommodate larger vessels. Such efforts are being rewarded as the port is considered one of 20 ports in the world that can accommodate 19,000 TEU vessels (Peters, 2016).

4.3 Summary of Literature and Theoretical Framework of China

In light of the above, the below figures depict the following: Firstly, steps which have been undertaken by China ports for purposes of creating additional capacity to handle vessel. Secondly, a theoretical framework, which depicts the steps and models that were undertaken by China Ports to create such capacity.

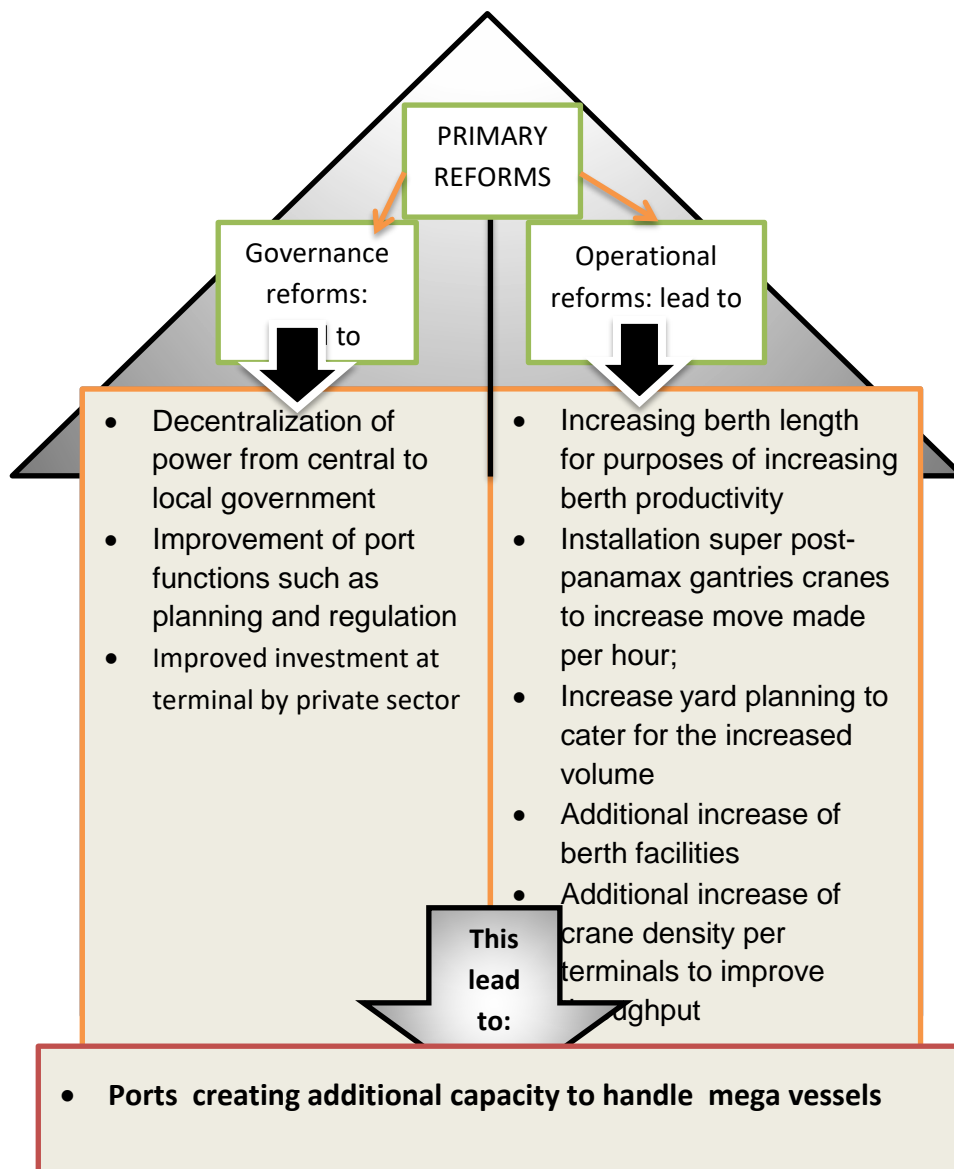


Figure 2: Theoretical Framework of China Ports

5. THE CASE OF DURBAN PORT

International lessons have shown that for any port to increase capacity and productivity both governance and operational framework should be in place. It is however the governance facet that should serve as a basis for the latter. When assessing the governance framework for Durban port, it is apparent that it stems from a background whereby the country followed a model of strong presence of the state in the ports sector (TIPS, 2014). Even in with the current model, there is still strong presence of the state with the Department of Transport (Central Government) serving as a line Ministry for the Port Regulator and the Department of Public Enterprises serving as the line Ministry for the National Ports Authority. Then Transnet National Ports Authority (TNPA) has oversight over the operations of Transnet Port Terminal (TPT) and any private operators that may compete with TPT; it is also key to note that TNPA and TPT are both part of the Transnet Group. In essence the current governance framework is still reflective of the strong

presence of government from the level of the Ministry, even towards operational level of ports operations.

Whilst the current governance framework is reflective of strong state presence, that has not deterred the port from achieving operational gains such as handling 65 per cent of the domestic container traffic (University of Kwazulu Natal, 2005). Secondly, achieving a combined capacity of 3.6 million TEUs per annum and operates as two terminals, Pier 1 and Pier 2 terminal (Transnet: 2014). . Currently both terminals handle 65 per cent of South Africa's container traffic (Asmal, 2015). Pier 1 has a nominal capacity of 700 000 TEUs and consists of three berths, with a draft of 12.5 metres, and it is equipped with a total of six super-post panamax gantry cranes backed by a fleet of Rubber Tyred Gantries cranes in the stacking area , which makes 53 moves per hour (Motau, 2015). Pier 2, has nominal capacity of 2, 9 million TEUs and consists of seven berths, with draft of 12.8 meters (planned to be increased to 16 metres). Furthermore with a fleet of over 100 modern straddle carriers, 19 shore side gantry cranes in service as well the new three of a total of seven tandem lift ship-to-shore cranes with a capability of loading or offloading 85 containers in an hour (ibid).

Whilst there is evidence that the port has managed to make meaningful operational strides under the current governance framework. It is however key to note that it is also beset by two primary challenges. Firstly, the framework has not provided a practical transition of how the port will respond to the current mismatch between vessel size development and developments in the actual port. Secondly, this limitation has resulted in the port being challenged by the ascendancy of mega container vessels which require modernised infrastructure to be able to dock effectively and efficiently. Therefore, it is important that the port considers aligning its development with vessel evolution and the necessary steps required to accommodate the same.

5.1 Durban Port Experience with Mega Ships

Generally, the driving force behind the introduction of larger vessels has been the need for increased economies of scale and cost reduction, and also establishing alliance arrangements that have come to dominate in the container liner service. Although mega vessels play a significant role in supporting shipping liners to realise key benefits in the maritime industry, reality on the ground demonstrates that bigger vessels are challenged by current infrastructure and operational systems in most ports. This view is underpinned by Dyer (2014) that ports like Durban are challenged by the ascendancy of vessels with a carrying capacity of over 12, 000 TEU and above. As a result trading routes connecting with Durban port have sporadically benefited handling such large vessels. On the other side there has been a decline in the number of vessels arriving on South African shores since 2003, decreasing from 14 300 per annum to approximately 12 122 in 2014, since the economic downturn as shipping lines have sought to stay competitive by running and deploying larger and more fuel-efficient vessels instead of many smaller-sized vessels in pursuit of economies of scale and greater efficiency (TPNA, 2014). This view is further reaffirmed by Container Shipping & Trading, (2014) that routes that connect with South African ports like Durban are now faced with container vessel callers up to 13 000 TEUs

on a regular basis, with Latin American trade experiencing a large increase in similar tonnage. There is therefore mounting anecdotal evidence that the port of Durban is progressively attracting bigger vessels, especially since shipping liners base their trade on the shipping route rather than a specific port. It is also important to consider that vessel developments will continue to gain momentum, since vessel owners do not purchase vessels with a single route in mind (OECD, 2015). Based on the preceding developments it is therefore essential to establish the critical steps required by the port to accommodate mega vessels at a regular basis.

5.2 Analysis of Durban Port

Whilst there are different institutions involved in the governance of the port of Durban reality on the ground depicts that competition for the provision of port services is still provided by TNPA. Actually, according to (TRIPS, 2012) the Public and private sector market share for major service categories is skewed towards Transnet, thus meaning that Transnet currently provides a large portion of the infrastructure services especially in container handling, providing upwards of 96%. Thus, indicating a need for a broader framework that will accommodate more private investment to offer additional services that can be responsive to the changing requirement of the port environment. Secondly, based on the current state of affairs it is apparent that there is an imbalance in terms of terminal capacity. Based on international experiences it has been proven that balancing terminals infrastructure provision has the potential to lead to an improvement of capacity and productivity of the port. There is a need to further investigate opportunities for the port in container subsystems, such as additional berths and automated quay cranes for purposes of improving efficiency at terminals. Lastly, it is apparent that the current vessels calling at Durban port are very small according to standards that have been reflected by Chinese ports, thus meaning the deepening of the port will need to be pursued to accommodate 13,000 TEUs vessels. It is against such backdrop that a framework should be developed for purposes of ensuring that as ports plan to grow capacity, they also make the right investments.

6. CONCEPTUAL FRAMEWORK

This section proposes a conceptual framework for the Port of Durban, which is informed by the theoretical framework of China ports. The proposed conceptual framework for the Durban port starts at broader level by deriving key lessons from China ports. The first lesson is in relation to the governance steps that were undertaken to improve the development of the port environment. Secondly, it looks into the investments that are necessary on operational activities for purposes of supporting operational efficiency at terminals and ultimately at a port level. Thirdly, it proposes components that are unique and informed by the case of Durban port for purposes of enhancing operations at the said port. In the context of Durban port, it can be indicated that the framework is also developed to respond to the geographical location of the port and the role it plays as a gateway for the Southern African region. In essence, the framework looks at pertinent issues that go beyond the port environment. It seeks to respond to the impact that the ascendancy of

mega vessels will have on other modes. Based on such realities, the framework also makes provision for the need to integrate road transport systems with railways systems as they will be impacted by the creation of additional capacity to accommodate mega vessels. The understanding is that once an additional container is added to the container terminal port that will impact on other transport modes. Lastly, the framework also alludes to the need to develop corridor infrastructure services that will support road freight traffic growth that might perhaps emanate from the effect of trading with larger vessels. The infrastructure services, relates to the need to develop facilities such as distribution centers and warehouses that are strategically located to service the city and hinterlands areas due an increase in trade activities. The provision of infrastructure also includes developing safe truck stops along the corridor to cater for high frequency travelling truckers due to improved trade activities and container movement. The framework does not propose for Transnet to assume the role of responding to provision for infrastructure services in areas like road and along the corridor. It however proposes for a transparent methodology that will enable for the integration of systems and information sharing between ports, road institutions and corridor structures for purposes of enhancing future planning in road, which might results from port development. The conceptual approach is depicted in the below figure.

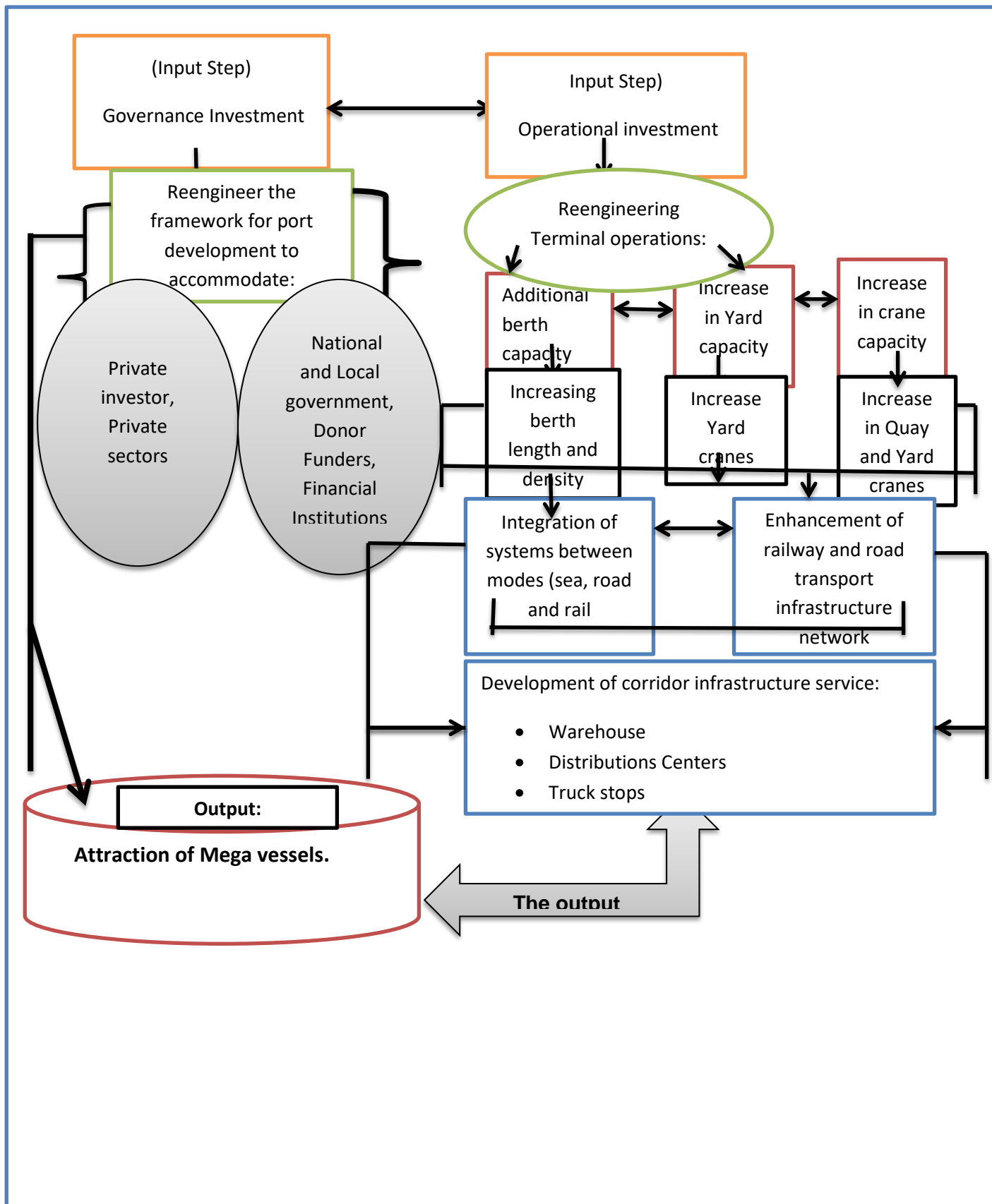


Figure 5: Conceptual Framework of Durban Port to Improve capacity for purposes of handling Mega Vessels

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