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Unlocking the landlocked : appraising the economic viability of dry ports for Zimbabwe

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UNLOCKING THE LANDLOCKED

APPRAISING THE ECONOMIC VIABILITY OF DRY PORTS FOR ZIMBABWE

By

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Zimbabwe

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Declaration

I certify that the material in this dissertation that is not my own work has been acknowledged and that no material is included for which a degree has previously been conferred on me.

Signature…….

Date……..…

The contents of this dissertation reflect my own personal views, and are not necessarily endorsed by the University.

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Dedication

Dedicated to my family for their commitment towards education, their reassurance throughout my studies and for sharing a unique learning culture.

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This research develops from wide-ranging literature on dry ports previously conducted by other researchers. I would like to acknowledge the invaluable information I have gathered from various books, journals and articles which I have used during my study.

Abstract

The purpose of this dissertation is to assess the feasibility of dry ports for landlocked developing countries, with particular reference to Zimbabwe. In order to adequately understand Zimbabwe's challenges, that is, the cost of being landlocked, the shippers' challenges are presented and discussed. These include long distance to seaports, delays at borders and long transit times which culminate in increased transport costs. High transportation costs and increased supply chain uncertainties impact negatively on exporters and importers ultimately distressing trade and economic development.

Given these circumstances, the dry port concept is introduced. Background studies to dry ports are examined. A dry port is an inland terminal directly connected to the seaport by high capacity transport such as rail. Contemporary studies claim that dry ports are an indispensable part of an integrated transport logistics system and provide many benefits. In this dissertation, the functions and benefits of dry ports in an integrated logistics system are explored to determine whether or not dry ports can provide the best solution for landlocked countries.

The researcher examined dry port possibilities at Beitbridge border posts. As a result, the freight volume passing through the border post was analysed. Recognising that dry port success and efficiency is a product of effective management and that a dry port differs from place to place, literature on existing dry ports was examined to benchmark the viability and sustainability of dry ports for Zimbabwe. The results from data analysis are used to justify dry port development for Zimbabwe as a solution to enhance its access to maritime transport and minimise the challenges of being landlocked.

Keywords: High transport costs, long distance, long transit time, dry ports, integrated transport, logistics system, supply chain uncertainty, maritime transport access, landlocked country, Zimbabwe.

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List of abbreviations

AfDB	African Development Bank
ASYCUDA	Automated System for Customs Data
BOT	Build Operate Transfer
BOOT	Build Own Operate Transfer
CFS	Container Freight Station
CIF	Cost Insurance and Freight
COMESA	Common Markets for East and Southern Africa
CRM	Customers Relations Management
CSO	Central Statistics Office
CTD	Combined Transport Document
CTO	Combined Transport Operator
CY	Container Yard
DRC	Democratic Republic of Congo
EDI	Electronic Data Interchange
ECA	Economic Commission for Africa
FDI	Foreign Direct Investment
FCL	Full Container Load
FDT	Association of Danish Transport and Logistics Centres
FEU	Forty-foot Equivalent Units
FOB	Free on Board
GDP	Gross Domestic Product
GCW	Gross Combined Weight
IMO	International Maritime Organization
LCL	Less than Container Load

LDC	Least Developed Countries
LLC	Landlocked Country
LLDC	Landlocked Developing Country
LPI	Logistics Performance Index
MTO	Multi-modal Transport Operator
NVOCC	Non-Vessel Operating Common Carrier
NRZ	National Railways of Zimbabwe
OSBP	One Stop Border Post
RMS	Road Motor Services
SADC	Southern African Development Community
SARA	Southern African Railways Association
TEU	Twenty-foot Equivalent Units
TMESA	Trade Mark East and Southern Africa
UN	United Nations
UNCLOS	United Nations Convention on the Law of the Sea
UNCTAD	United Nations Conference on Trade and Development
UN-OHRLLS	United Nations Office of the High-Representative for Least Developed Countries, LLDCs and Island States
WBCG	Walvis Bay Corridor Group
WTO	World Trade Organization

Chapter 1: Introduction

This chapter begins by presenting the research background. The research setting is then presented and Zimbabwe is introduced as one of the six landlocked countries in Southern Africa. Subsequently, the challenges faced by Zimbabwean shippers are summarised in the problem identification section. Afterwards, the possible solutions to improve the maritime access of landlocked country are listed, among which is the dry port concept. Later, the research objectives, research and limitations are outlined. The chapter closes by presenting the structure of the research.

1.1 Research background

Zimbabwe is a landlocked country (LLC) in Southern Africa. The United Nations Convention on the Law of the Sea (UNCLOS) defines a landlocked country as a State with no sea coast[1] (UNCLOS, 1982). Therefore, an LLC is a country that is entirely enclosed by land, has no direct contact with the ocean at its borders and, hence, has no coastline. UNCTAD[2] (2003) explained that a landlocked country has a geographic handicap in that it is distanced from the seaports (UNCTAD, 2003, p. 1). As a result of this geographic disadvantage, a landlocked country has challenges with maritime transport access. To compound these challenges, a landlocked developing country (LLDC) is faced with a more problematic situation emanating from both its geographic position and economic difficulties. Resultantly, an LLDC is often poorer than its coastal neighbours (UCTAD, 2003).

Through containerisation and globalisation, dry ports have emerged. Dry ports are transhipment centres for cargo from seaports to inland destinations and vice versa. Globally, dry ports have been welcomed as an indispensable part of a modern multimodal transport logistics system. Notably, in Africa, most countries have embraced dry ports with customs procedures carried out at dry ports. An example is

[1] UNCLOS, Article 124, (1a).
[2] UCTAD, 2003 Report on challenges and opportunities for further improving the transit systems and economic development of landlocked and transit developing countries.

South Africa, where the City Deep dry port relieves capacity problems at the port of Durban. Similarly, in Ethiopia, export and import goods are cleared at the Modjo dry port instead of the port of Djibouti (Kunaka, 2013).

Dry ports located in landlocked countries, such as Zimbabwe, connected to the seaports with efficient rail represent an economic tool for minimising maritime transport access challenges and promoting economic growth and competitiveness of landlocked countries.

The agenda for dry ports has been high in Zimbabwe over the past decade. In September 2009, the government of the Republic Namibia granted on lease to Zimbabwe, about 19 000 square metres of land on which to construct its own (close range) dry port at Walvis Bay[3] with the objective of improving Zimbabwe's trade with Europe and North America. While it is transparent that a close range dry port will not only reduce seaport congestion but also attract more cargo from Zimbabwe and neighbouring countries to the seaport, a dry port that is over 2, 000 kilometres away from the shippers is unlikely to benefit Zimbabwean shippers in eliminating the traditional costs of being landlocked since the problems of long distance and multiple borders remain unsolved.

Despite the fact that in Southern Africa, many countries are at different stages of dry port investments, the researcher is of the opinion that close-range dry ports located in maritime states serve no economic benefit to shippers from landlocked countries if the factors of distance, time and transport mode remain unchanged. The contribution of this research is to expand existing literature on maritime transport and logistics by focusing on dry ports as a particular area of interest to both landlocked and maritime countries. Besides, dry ports may provide a lasting solution to the problems of LLCs.

[3] Financial Gazette, August 30, 2012: Zimbabwe's Walvis Bay Gift.

1.2 Research objectives

Given the aforesaid research background, this research seeks to address the following research objectives:

- To review the challenges faced by Zimbabwean shippers when accessing maritime transport.
- To review and explain the importance of dry ports in modern transport logistics systems.
- To explain the functions and benefits derived from dry ports and to highlight how LLDCs can benefit from the dry port concept.
- To establish whether a border dry port is feasible at Beitbridge border post which is Zimbabwe's main maritime transport gateway.

1.3 Purpose of research

The purpose of this research is to identify an optimal solution to the challenges faced by landlocked countries. In this view, the researcher studies dry ports as the holistic solution to improve maritime transport access for landlocked countries. The paper provides a link between the challenges of being landlocked and the dry port concept.

In addition to justifying improvement in maritime transport connectivity, the purpose of this study is to highlight the numerous benefits that may be achieved through a dry port. These benefits are endowed to all stakeholders in the transport chain.

Most studies have focused on dry ports in coastal countries. However, this research investigates a potentially unique case where border dry ports could effectively enhance a landlocked developing country's transportation and logistics services and improve its trade participation.

The motivation for conducting research on dry ports has been prompted by modern trends in maritime transport as seen through seaport-hinterland integration and the integration of shipping companies along the supply chain. Therefore, LLDCs must wake up to the call otherwise they continue to lament their curse which is twofold; one of being landlocked and another of being a least developed country (LDC).

1.4 Scope of research

This research is intended to illustrate the applicability of dry ports as a means of improving the accessibility of maritime transport to landlocked countries. Dry ports take a strategic position in the logistics chain and influence both seaport and hinterland locations as highlighted in figure 1.

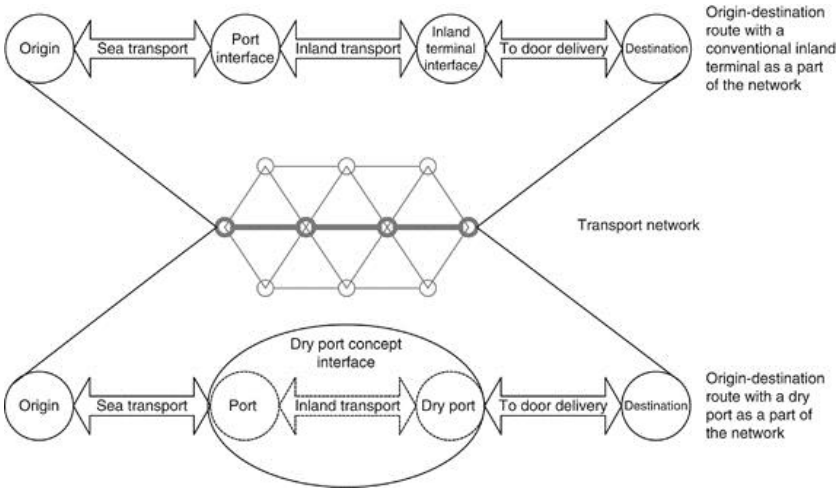


Figure 1. Scope of research.

Source: (Roso & Lumsden, 2010).

Figure 1 shows the fit of the dry port on the origin to destination route. It shows the position of the dry port in an integrated transport network (Roso & Lumsden, 2010)

1.5 Research methodology

A quantitative research approach was used to quantify data gathered from various sources and expert opinion on dry ports. A questionnaire was used as the primary data collection tool. Data analysis involved statistical analysis of variables and forecasting. Later a case study of the Beitbridge border post was conducted and a SWOT analysis technique was used to support the development of dry ports.

Both primary and secondary data collection methods were utilized. The primary data collection method used was questionnaires. Mostly, throughout the dissertation, secondary data was utilised. The researcher chose to exploit this approach since there were numerous databases with accessible information on dry ports.

1.6 Research structure

This research is divided into six chapters. The research progression is detailed below:

Chapter 1 provides the research background, the objectives, purposes, scope and structure of the research. It also highlights the methodology applied in conducting the research.

Chapter 2 reviews literature on the challenges of landlocked countries and on dry ports. It covers issues such as the high costs of being landlocked, types of dry ports and their associated benefits to different stakeholders. In addition, examples of dry ports are analysed.

Chapter 3 discusses the multimodal transport regime in Zimbabwe. The discussion covers Zimbabwe's maritime trade gateways and strategic logistics corridors. It concludes by showing the link between the current system and the proposed system with a dry port with the objective to show the fitness of a dry port in an integrated transport system.

Chapter 4 analyses the suitability of dry ports for Zimbabwe. It describes the research methodology, types of data collection methods used and shows how data analysis was carried out using the methods adopted. The researcher analyses the case of Beitbridge as a dry port. This leads to a cost-benefit analysis, a SWOT analysis. The chapter ends by presenting a dry port planning and implementation strategy.

Chapter 5 summarises the research. It begins by explaining the findings from data analysis and literature review. Afterward, the economic significance of dry ports for Zimbabwe is explained based on results from data analysis. Further to that, the implications of the research are highlighted. The chapter concludes with the presentation of the conclusions, limitations and recommendations.

Chapter 2: Literature Review

2.1 Introduction

In this chapter, the researcher carries out a comprehensive study on the issues of being landlocked in order to identify problems. Afterwards, the literature on dry ports is reviewed in order to understand the solution. In this regard, a number of case studies on dry ports are reviewed to identify how the projects were successfully implemented. Later, examples of established dry ports are studied to establish their success stories and provide lessons from which Zimbabwe can learn.

2.2 Challenges faced by Zimbabwe as a landlocked country

Like many landlocked countries, Zimbabwe faces challenges with access to maritime transport. The primary challenge is that Zimbabwean shippers travel long distances in order to reach seaports in neighbouring countries. Long distances to seaport result in high transport costs driven by complex logistics. Consequently, high transport costs have negative impacts on shippers in both export and import businesses as fewer traders will be able to operate. This results in reduced trade-led economic growth. Table 1 highlights the distance challenge for Zimabwe. Zimbabwe's capital city, Harare, is used as the reference point.

Table 1. Zimbabwe distances to seaports[4]

	Distance to seaports (Kilometres)					
Seaport	**Beira**		**Durban**		**Walvis Bay**	
Mode	**Road**	**Rail**	**Road**	**Rail**	**Road**	**Rail**
Harare →	565	593	1, 687	2,024	2, 515[5]	*[6]

Source: (Jorgensen, 2000).

Table 1 illustrates the long distances travelled by Zimbabwean shippers in order to reach seaports in neighbouring countries. In spite of Beira being so close to Zimbabwe, the port has been plagued with congestion and draught challenges, thereby restricting the number and size of ships calling at the port[7]. Instead, the port

[4] See Appendix E for detailed distance to all seaports.
[5] Distance as given by Walvis Bay Corridor Group, valid when using Trans-Caprivi corridor
[6] No direct rail connection. Rail link resumes in Zambia.
[7] As shown in appendix D, between 2006 and 2007, Beira had only 1% container traffic share.

of Durban is primarily the shipper's choice due to efficient cargo handling capabilities and capacity to handle modern post-Panamax vessels.

Arvis, Raballand and Marteau (2007) discussed the logistics and supply chain reliability aspects of being landlocked and established that despite the tremendous reduction in maritime transport cost and advancement logistics technology that reduces transport costs, lack of direct sea-access is a major challenge for the growth and development of LLDCs (Arvis, Raballand, & Marteau, 2007, p. 3)

Arvis, et al. (2012) explained the detrimental effect of high logistics costs to the competitiveness of developing landlocked countries in world markets. The authors clarified that the combination of long distances and poor logistics systems is unattractive for trade. To compound this, rent-seeking activities along the corridors make logistics highly complex and unpredictable (Arvis et al., 2012).

Arvis, et al. (2007) explained that on average LLDCs trade 30% less than coastal States and pay 50% extra in transport costs (p. 5). Evidently, this is true in the case of Zimbabwe where transport costs are at least 50% higher than those of their coastal neighbours. Table 2 illustrates the differences in cost for shipping a single 20 foot container for the period from 2009 to 2013.

Table 2. Zimbabwe's costs to export in USD per container

	2009	**2010**	**2011**	**2012**	**2013**
Zimbabwe	3, 280	3, 280	3, 280	3, 280	3, 765
South Africa	1, 531	1, 531	1, 531	1, 620	1, 705
Mozambique	1, 100	1, 100	1, 100	1, 100	1, 100

Source: (World Bank, 2008; World Bank, 2010; World Bank, 2013).

Table 2 reveals that Zimbabwean shippers pay at least 50% more than those in South Africa and Mozambique. This cost difference is mainly due to the state of being landlocked.

As Faye et al. (2003) explained, it can be concluded that relative proximity to a seaport (e.g. Beira in Mozambique) does not guarantee low transport costs for a landlocked country like Zimbabwe.

The World Bank (2008) stated that high transportation costs for LLCs are a product of longer distances to seaports coupled with increased transit time, multiple border clearances and delays. The World Bank (2008) confirmed that the time taken to travel from the seaport to the destination is usually double for landlocked countries when compared to coastal countries. Moreover, being landlocked adds four days to exports and nine days to imports (p. 5). Consequently, goods destined for landlocked countries stay longer in transit and at intermediate nodes than those bound for coastal states (World Bank, 2008).

Carmignani (2012) discussed the curse of being landlocked and discovered that isolation from global markets affects economic development (p. 3). The overall conclusion was that landlockedness reduces international trade flows and hence economic development. This is also attributable to bad policy issues and poor institutional quality (Carmignani, 2012).

Faye et al. (2003) conducted a case study that analysed the challenges facing landlocked developing countries focusing on political relations and infrastructure. The authors explained that high transportation costs present LLDCs with a distinct disadvantage when compared to their coastal neighbours, particularly when competing in global markets (p. 8). Moreover, LLDCs are dependent on the transit and infrastructure levels of their neighbours, which may be weak[8]. In addition, bad political relations with coastal neighbours present LLCs with unpleasant conditions[9]. Worse still, civil war in coastal countries may close transit routes (Faye et al., 2003).

[8] This describes the case between Zimbabwe and Mozambique. While Mozambican ports are close, poor infrastructure and port inefficiency have led to shipper relying on South African ports instead.
[9] This is the case between Ethiopia and Eritrea. Despite the long distance, Ethiopia is left to trade through port of Djibouti because of political standoff between Ethiopia and Eritrea.

Arvis et al. (2012) wrote that supply chain uncertainty is predominantly a problematic issue for shippers in LLDCs due to increased lead times. Increased lead times in turn result in high inventory costs arising from stockholding and in-transit inventory costs that eventually inflate the final cost of products on the market. In-transit delays also arise from road tolls, weigh bridges and lengthy delays at border posts (Arvis et al., 2012). Evidently, Zimbabwe is among the few countries with the longest times to export and imports goods (World Bank, 2008, World Bank 2010).

Arvis et al. (2007) explained that landlocked countries have long transits and can only trade through the transit systems of their coastal neighbours (p10). Figure 2 illustrates the lengthy transit and clearance system.

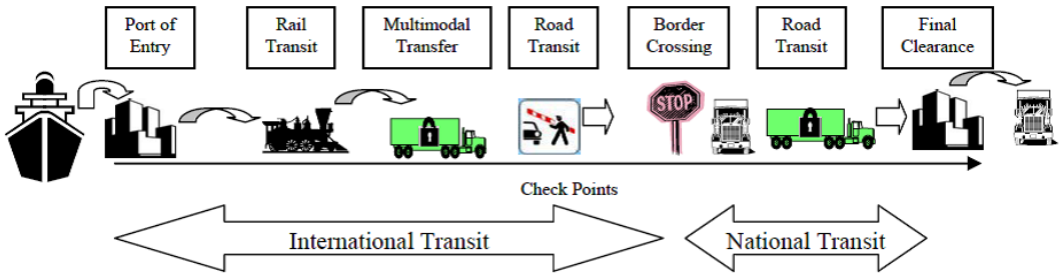


Figure 2. The prolonged transit time faced by LLCs.
Source: (Arvis et al., 2007).

From Figure 2, prolonged transit time through systems governed by many private and public stakeholders exposes the transit systems to complexity and vulnerability to rent-seeking activities[10] (Arvis et al, 2007, p 10; Arvis et al., 2010, pp. 41-44).

Complex logistics have negative impacts on logistics performance. The World Bank logistics performance index (LPI) is a tool developed by the World Bank to measure a country's logistics performances across a panel of countries. These assessments assist to identify challenges and opportunities and hence help a country to improve logistics performance. To establish how Zimbabwe has been performing in logistics terms, Table 3 analyses Zimbabwe's LPI trend.

[10] Details on rent seeking activities are shown in appendix F.

Table 3. Zimbabwe Logistics Performance Index: 2007– 2014

	2007 LPI			2012 LPI			2014 LPI		
Economy	Rank	Score	% of Highest	Rank	Score	% of Highest	Rank	Score	% of Highest
Zimbabwe	114	2.29	40.3	103	2.55	49.6	137	2.34	42.9
				11.3% improvement compared to 2007 LPI.			8.2% decline in compared with 2012.		

Source: (World Bank, 2007; World Bank, 2012; World Bank, 2014).

Table 3 reveals that Zimbabwe's logistics performance rank and score improved from 114 and 2.29 in 2007 to 103 and 2.55, respectively, in 2012. However, the LPI rank fell by 34 points from the 2012 rank of 103 to the 2014 rank of 137 with the LPI score declining by 8.2% from 2.55 in 2012 to 2.34 in 2014 (Arvis et al., 2012; World Bank, 2007; World Bank, 2012; World Bank, 2014). This instability in logistics is attributed to challenges in maritime access.

Delays emanating from border posts threaten Zimbabwean shippers. Explaining delays, the African Development Bank (AfDB, 2003) stated the average time spent at Beitbridge border post as 35 hours (AfDB, 2003). Delays create border congestion and further compound logistics costs[11]. Curtis (2009) studied the delays at Chirundu One Stop Border Post (OSBP) between Zambia and Zimbabwe and concluded the facts in Table 4. (Also refer to appendix J for full chart.)

Table 4. Border delays at Chirundu OSBP

Year	2006 / 2007		Border crossing times in hours								
	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Single Line/ Break Bulk	50	32	49	35	33	42	48	32	48	42	40
Refridgerated	20	35	25	38	25	28	42	32	22	15	20
Container	42	25	30	38	48	55	48	40	35	30	40
Multiple Line / Console	48	47	46	45	40	52	70	60	35	45	60
Tanker	30	48	25	22	21	22	33	38	35	31	30
Average	38	37.4	35	35.6	33.4	39.8	48.2	40.4	35	32.6	38

Source: Curtis (2009).

[11] UNCTAD (2013) asserts that the cost of crossing a border in LLDCs in Africa may be compared to travelling 11, 000 kilometres by maritime transport or 1,600 kilometres by inland transport whereas in Western Europe, border delay is compared to only 160 kilometres of inland transport.

Table 4 illustrates that the average border transit time ranged between 32 to 38 hours depending on the type of vehicle and, possibly, other factors such as type of cargo carried. Evidently, the total time spent to cross the border is at least one day. This shows a huge difference when compared to Europe where border crossing time varies between 30 to 40 minutes (UNCTAD, 2003, p. 7).

Zimbabwe has the longest export and import times due to landlockedness. The World Bank's "Doing Business" [12] report is a series of annual reports that investigate and highlight quantitative indicators of regulations that enhance business activity and those that constrain it, measured across a panel of about 185 countries (World Bank, 2014).[13] Table 5 summarises the effect of landlockedness on supply chain efficiency looking at the times taken to export and import between 2012 and 2014.

Table 5. Zimbabwe's doing business profile: Export/Import profile

	2012	2013	2014
Exports			
Documents to export (documents required)	8	8	7
Time to export (days)	53	53	53
Cost to export (US$ per container)	3, 280	3, 765	3, 765
Imports			
Documents to import (documents required)	9	8	8
Time to import (days)	73	73	71
Cost to import (US$ per container)	5, 101	5, 200	5, 660

Source: (World Bank, 2012; World Bank, 2013; World Bank, 2014).

Table 5 highlights the findings from a literature analysis of Zimbabwe's trading profile. Evidently, as a landlocked country, Zimbabwe takes a long time to export and import. Despite the improvements in global logistics, it has not been the same for some LLCs, particularly Zimbabwe. Zimbabwe's time to export remained stagnant at 53 days in both 2013 and 2014 while the time to import narrowly decreased by 3% from a high of 73 in 2013 down to 71 days in 2014 (World Bank, 2014).

[12] World Bank Doing Business 2014; Understanding Regulations for Small and Medium-Size Enterprises

[13] "Doing Business" compared 183, 185 and 189 economies in 2012, 2013 and 2014 respectively

The stagnation of export and import costs at high levels shows the severity of the logistical challenges that Zimbabwe needs to address. To establish the breakdown of transport costs, the researcher analysed Zimbabwe's export and import profiles as summarised in Table 6.

Table 6. Zimbabwe procedures for export and import

Nature of export procedure	**Duration (Days)**	**Cost US$**	**Nature of import procedure**	**Duration (Days)**	**Cost US$**
Documents preparation.	33	300	Documents preparation.	42	360
Customs clearance and technical control.	4	180	Customs clearance and technical control.	6	350
Ports and terminal handling.	4	285	Ports and terminal handling.	9	450
Inland transportation and handling.	12	3,000	Inland transportation and handling.	14	4,500
Totals	**53**	**3,765**	**Totals**	**71**	**5,660**
Export documents: Bill of Lading , Commercial invoice , Customs export declaration (Form 21), Exchange Control CD1 forms, Packing list ,Pre-shipment inspection clean report of findings, Transit entry documents (South Africa's Form SAD500)					
Import documents: Bill of Lading, Cargo release order, Certificate of origin, Commercial invoice, Customs export declaration (Form 21), Packing list, Road manifest, Transit entry documents (South Africa's Form SAD500)					

Source: (World Bank, 2014).

Table 6 summarises the breakdown of costs, procedures and documentation required for export and import. Zimbabwean shippers pay on average $3,765 for export and $5,666 for import of one TEU. These extremely high transport costs undermine competitiveness and significantly drag investment and entrepreneurship. UNCTAD (2003) highlights that trade costs for LLDCs are higher when compared to those of developing coastal states. UNCTAD proclaimed the in 2003, trade costs for LLDCs were 12.9% while those of coastal states were 8.1% and developed countries had 5.8%. It can be concluded that LLDCs bear extra costs of 4.8% and 7.12% when compared with developing coastal states and developed countries respectively (UNCTAD, 2003).

Evidently, there is high negative correlation between transport costs and exports. When transit costs rise, the share of exports in GDP[14] for LLCs is significantly

[14] Gross Domestic Product. The share of exports in GDP is the country's net export (net barter terms of trade) calculated as exports minus imports.

reduced. Moreover, potential gains from both exports and imports for LLDCs are lost in transit costs. The result is undesirable reduction in export-led economic growth. (UNCTAD, 2003).

As a result of remoteness from seaports, LLDCs have relatively lower GDP per capita compared to coastal economies as shown in appendix G. Therefore, they are disadvantaged in terms of competitiveness (UNCTAD, 2013, p. 3). This is further worsened by the fact that LLDCs import more than they export creating trade imbalances.

The UN-OHRLLS (2013) asserts that on average, LLDCs are 20% less developed than they would have been had they been coastal. Figure 3 summarises the challenges faced by LLDCs (UN-OHRLLS, 2013).

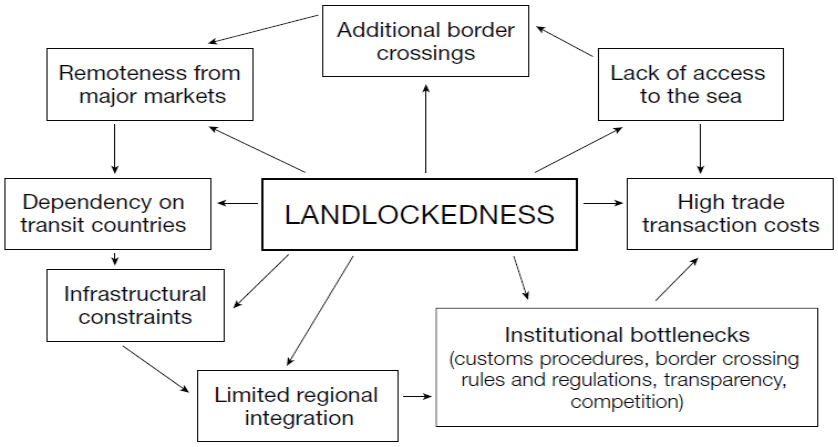


Figure 3. Challenges faced by LLDCs.
Source: (UN-OHRLLS, 2013, p. 4).

Figure 3 summarises the problems faced by LLCs which include remoteness from world markets, multiple border crossings and institutional bottlenecks. The UN-OHRLLS (2013) explained that between 2005 and 2010, Zimbabwe was among the countries experiencing the highest development costs above 30% due to landlockedness. As a result, its development was 22% lower than it would have been had the country been not landlocked (UN-OHRLLS, 2013, p. 40).

2.3 Review of dry ports literature

Given the aforementioned challenges of landlocked countries, the researcher reviewed dry ports literature to establish the significance of dry ports as a solution to the challenges of LLDCs.

A dry port is an inland intermodal terminal directly connected to the seaport by high capacity mode. In the case of Zimbabwe and other African landlocked countries, rail transport is the only applicable mass means of transport since waterways are unsuitable for navigation to seaports.

Leveque and Roso (2002) gave the following dry port definition:

> *"A dry port is an inland intermodal terminal directly connected to seaport(s) with high capacity transport mean(s), where customers can leave/pick up their standardised units as if directly to a seaport."* (Leveque & Roso, 2002).

The same description was recognised through the works of Veenstra and Zuidwijk (2010), Dryport Project (2012), Henttu et al. (2010) , TransBaltic (2012, p. 12) and Woxenius et al. (2004). Woxenius at al. (2004) emphasized that customers can leave or pick up their goods "as if directly at seaport" and concludes that a dry port is an extension of the seaport.

The works of (Roso, 2004; Roso, 2008; Roso, 2007; Dryport Project[15], 2009; Bergqvist et al., 2013; FDT, 2010; Rodrigue et al., 2010; UNCTAD, 1991) recognised the importance of dry ports through extensive research on the functions and benefits of dry ports as part of a logistics system. For instance, dry ports relieve seaports by shifting some of the activities initially done at the seaport to the dry port thereby relieving the seaport of congestion (Roso, 2008; Ng, et al., 2013; Bergqvist et al., 2013).

Dadvar et al. (2010) conducted a feasibility of dry ports in LLCs and concluded that dry ports reduce truck distances and improve trade (Dadvar et al., 2010, p33).

[15] The Dryport Project 2009 to 2012,all press releases retrieved from http://www.dryport.org/

FDT (2007) explained that a dry port is normally governed by rules similar to those used at the seaport and further stated three conditions for a dry port status as:

1. The dry port must have direct connection to the seaport.
2. The terminal should have high capacity transport mode, such as rail.
3. The dry port should offer similar facilities as those found at the seaport (FDT, 2007; Woxenius et al., 2004).

Explaining the same concept, UNCTAD (1991) in its handbook of the management and operations of dry ports clarifies that a dry port is an inland terminal where shipping companies[16] issue bills of lading for both export and import shipments. It is important to emphasise that when cargo is left at a dry port, shippers have the impression that the cargo has actually reached a seaport (UNCTAD, 1991).

TransBaltic (2012) acknowledged that there are some shippers (and cargoes) that cannot cope with rail transport[17]. Consequently, duo trailers can serve these customers and supplement rail transport between the seaport and the dry port (p. 18). The authors claim that duo trucks minimise transport costs, reduce fuel consumption and CO_2emission by 27% compared to standard trucks (TransBaltic, 2012).

The development and success of dry port requires the involvement and participation of all stakeholders (Roso, 2008; Monios, 2010; Drypory Project, 2010). The Dryport Project (2010) explained that public-private partnerships should be effectively integrated to ensure the success of the entire project (Dryport Project, 2010). Also, Jaržemskis and Vasiliauskas (2007) supported that dry ports should work in harmony with the seaport and hinterland markets to achieve efficiency (Jaržemskis & Vasiliauskas, 2007).

Ng et al. (2013) expressed international trade as a driver for dry port development. The authors explained that the rapid expansion of international trade and development of multimodal supply chains has triggered seaports to respond to the

[16] Shippers include freight forwarders acting as agents and NVOCCs who issue house bills of lading. NVOCCs act as virtual shippers and virtual carriers.
[17] Perishables and Just-in-time (JIT) components

developments by investing in dry ports in order to control the supply chain (Ng et al., 2013). Supporting this, Chandrakant (2011), in his essay on dry ports explained that the fast-paced growth in international trade between countries has triggered exhaustion of port facilities and incapacity to handle huge trade volumes. Hence dry ports were developed to support seaport logistics (Ng et al., 2013; Chandrakant, 2011).

Rodrigue and Noteboom (2014) explained that capacity issues are the main drivers for dry port development. In this view, dry ports become an indispensable solution to the challenges of both seaports and inland destinations (Rodrigue & Notteboom, 2014, p. 21).

Monios (2012) presented a paper on the increasing role of dry ports in hinterland locations. The author suggests that seaports are under pressure to innovate and cope with capacity constraints, competition and developments in logistics and supply chain management (Monios, 2012, p. 13).

UNESCAP (2013) claimed that dry ports play a pivotal role to integrate modes of transport, reduce border-crossing and transit delays and facilitate the use of energy-efficient and sustainable transport. Moreover, dry ports can work as seaports in LLCs thereby improving competitiveness (p. 1). In addition, dry ports create new opportunities and address specific needs of landlocked countries (UNESCAP, 2013).

The Dryport Project (2012) also maintained that dry ports can principally carry out all the functions and value-added services of a seaport necessary for shipping and forwarding of cargoes (Dryport Project, 2012, p. 39). The Dryport Project (2012) also explained that one of the primary purposes of a dry port is to promote the modal shift of freight from road onto more environmentally sustainable modes such as rail and inland waterways (Dryport Project, 2012, p. 3).

The African Bank (2010) discussed the development of African hub ports and explained that dry ports reduce container dwell time at seaports by moving them by

rail to inland locations (p.191). The African Bank report affirmed the UNESCAP report that dry ports open opportuties for private investment in transportation.

In their report, Roso, Woxenius, and Lumsden (2008), explained the dry port concept and analysed three types of dry ports namely close-range, mid-range and distant dry ports. The authors explained many benefits that can be derived from dry ports which are beneficial to all stakeholders. Importantly, the authours identified rail as the denominator that acts as a high capacity mode between the seaport and the dry port.

Beresford (2009) made a comparative analysis between UK and Nigerian dry ports and highlighted that dry ports where traditionally developed for landlocked countries whereas the concept of ICD was mainly used in maritime states. The author explained that the location of dry ports relative to transport infrastructure is very important for dry port success (Beresford, 2009).

Kunaka (2013) analysed different stages of dry port development in Africa and presented case studies on African dry ports. The author explained that empty trips associated with road transport may be reduced by dry ports while at the same time empty container redeployment is optimised. The author also mentioned that shipping lines and logistics players, such as the Bolloré African Logistics, have made great strides in dry ports and inland logistics.

In an economic review, the Economic Commission for Africa[18] (ECA, 2009) supported that it is logical for landlocked countries to take advantage of dry ports to develop and improve their trade and competitiveness.

[18] ECA Press Release No. 70/2009: Experts and official discuss "Dry Ports" in Ethiopia.

2.4 Drivers for dry port development

The following factors and trends in shipping and transport logistics influence the development of dry ports.

2.4.1 International trade

The rapid growth in international trade demand arising from both regional and international shippers has triggered demand for maritime transport. This has led seaports to respond to the development by investing in dry ports to counter capacity challenges and control the supply chain (Ng et al., 2013).

Put into context, Zimbabwe is a developing country with an agrarian economy and abundant natural resources that are, up-to-now, exported to importing destinations in semi-processed form. These shipments stimulate demand for seaborne trade. Similarly, there is substantial growth of containerised freight traffic.

2.4.2 Seaports and global terminal operators

Capacity challenges at seaports are the main driver for dry port development. Port incapacities are induced by rapid growth in trade. Moreover, congestion from trucks results in port inefficiencies (Chandrakant, 2011). Consequently, seaports are compelled to shift some port services to inland dry ports. Moreover, the growth potential of seaports is restricted by proximity to sensitive coastline activities like tourism, aquaculture and metropolitan areas which limit their expansion capacity (Rodrigue & Notteboom, 2014, p. 21).

In addition, modern terminals and railways projects are managed by the private sector, mainly global terminal operators (such as APM Terminals and Hutchison Port Holding - HPH) who have interests in inland logistics. Notteboom (2004) explained that Hutchison has reoriented its investments towards inland logistics in China. In Africa, APM Terminals recently opened the new Mombasa[19] dry port in Kenya.

[19] APM Terminals Press Release, 4 February 2013

In Africa, the Bolloré African Logistics, an integrated logistics service provider operates many dry ports in many countries (Kunaka, 2013). Therefore, seaports, terminal operators and third part logistics operators initiate dry port development.

Noteboom (2002) and Albergini (2002) highlighted that in Europe, especially in Germany, port operators are directly involved in inland terminals and rail transport operation. For example, Eurogate was successful in creating a rail land bridge between German and Italy (as cited in Notteboom, 2004).

2.4.3 Road congestion

In southern Africa, road transport dominates freight transport to seaports. This is mainly because of the flexibility of trucks to handle intermodal transport units, ITUs[20] (Roso, Woxenius, & Olandersson, 2006, p. 3). Moreover, road transport has the flexibility to offer door-to-door delivery service (FDT, 2011, p. 16). However, road transport results in excessive congestion, noise and CO_2 emissions in seaports cities and along corridors (Notteboom, 2004). Dry ports seek to minimise this congestion.

2.4.4 Environmental Concerns

The emission of pollutants like carbon dioxide (CO_2), nitrogen oxide (NO_X) and other hydrocarbons (HCs) significantly impacts on the environment. This poses a threat to the health of people, animals and the environment (FDT, 2011, p. 19). The CO_2emissions from road transport are five times more than rail transport (p. 20). Understanding that CO_2 emission efficiency of transport for a given period is given by the equation:

$$CO_2 Emmission = \frac{Fuel\ consumption/Km * gCO_2/km}{Payload} = gCO_2/per\ tonne.Km$$

Then logically, rail transport by virtue of having economies of scale, is more efficient than road transport[21]. The IMO (2009) report on greenhouse gases (GHG) acknowledged that the efficiency of road freight ranges from 80 to 180 gCO_2/tonne-km with an average of 150 gCO_2/tonne-km (p. 130). Meanwhile rail freight

[20] May be a container, a swap body or semi-trailer
[21] See also appendix C which compares road and rail transport.

efficiency ranges from 10 to 119 gCO_2/tonne-km with an average of 48 gCO_2/tonne-km (p. 133). The conclusion it that when compared to road transport, rail transport is at least 3 times more efficient and hence a more energy efficient and environmentally friendly mode of transport.

2.4.5 Containerisation and standardisation

Born in 1957, containerization subsequently led to the standardisation of cargo transport units for multimodal transportation to inland destinations (Dryport Project, 2009). The unitisation and containerisation of seaborne cargo led to increased cargo handling efficiency. Containerisation facilitated development of dry ports and inspired rapid growth of door to door delivery services.

2.4.6 Globalisation of supply chains.

The globalisation of supply chains has transformed seaports into value added logistics hubs. According to Notteboom (2004), deregulation, logistics integration and containerization have redefined port and shipping industries (Notteboom, 2004, pp. 86-106). Value addition has further increased demand for sea transport and indeed modern ports are attracting demand from their hinterlands by offering shippers value added services. The influx of activities around the port has necessitated the development of dry ports in the hinterland areas (Notteboom, 2004).

2.4.7 Modal shift from road to rail and inland waterways.

In Western Europe, for example, most ports have shifted from traditional road to rail[22] and inland waterway transport[23]. For instance, 50% of the Port of Gothenburg's hinterland connections are covered by rail transport (Chandrakant, 2011). Moreover, the Port of Gothenburg is connected by rail to 23 different destinations and dry ports (FDT, 2012, p. 13). The benefits are substantial and include achieving economies of scale and reduced transport costs since rail transport costs less per kilometre when

[22] European Commission (2013) highlighted that rail constitutes 11% of freight transport in EU.
[23] European Commission (2013) reveals that inland waters constitute 3.7% of EU freight transport based on tonne-kilometres. In the United State, it accounts for over 15% of commodity exports, connecting the interior of the country to ports, which connect to the rest of the world.

compared to road transport (UNCTAD[24], 2011). Moreover, environmental objectives are achieved by reducing carbon emissions and contributing towards green logistics.

2.4.8 Government Initiatives

Government pursuits to improve maritime access may trigger dry port project development (Roso, 2009). The most important driver for LLDCs is the quest to minimize transport costs and improve overland logistics and supply chain efficiency. Consequently, when governments venture into dry ports, they achieve both economic and social benefits since dry ports improve trade and also create jobs.

Cullinane et al. (2012) studied dry ports and concluded that governments play an important role in formulating policy and regulatory controls to facilitate dry port development. Studies by Ng and Gujar (2009b) and Ng and Tongzon (2010) show that government participation influences regional integration and harmonization of policies such as customs procedures and border agency cooperation (as cited in Ng et al., 2013). In order to address climate change, governments are aiming at developing sustainable transport solutions designed to reduce their carbon footprint[25] (Cullinane et al., 2012). Since dry ports support transhipment from road to rail, they are a welcome development that not only improves maritime access but assists governments to meet their environmental objectives.

[24] UNCTAD, Review of Maritime Transport, 2011
[25] Clean Development Mechanisms (CDM) as outlined in the Kyoto Protocol.

2.5 Types and benefits of dry ports

Roso et al., (2004) identified three types of dry ports namely short range, medium range and distant dry ports. Table 7 summarises the types of dry ports and the benefits associated with each type of dry port according to Roso et al., (2004).

Table 7. Types of dry ports by location and function

	Distant dry port	**Midrange**	**Short range**
Distance from Seaport	> 500 Kilometres from port	100 to 500 Kilometres	Less than 100 Kilometres
Benefits to seaport	• Less congestion • Expanded hinterland • Interface with hinterland	• Less congestion • Interface with hinterland • Dedicated trains • Depots	• Less congestion • Increased capacity • Depots • Direct loading
Benefits to seaport cities	• Less road congestion • Land use opportunities	• Less road congestion • Land use opportunities	• Less road congestion • Land use opportunities
Benefits to rail operators	• Economies of scale • Gain of market share	• Economies of scale • Gain of market share	• Economies of scale • Gain of market share
Benefits to road operators	• Less time spend in congested roads and terminals	Less time spend in congested roads and terminals	Less time spend in congested roads and terminals
Benefits to shippers	• Improved seaport access • Environment marketing	• Improved seaport access • Environment marketing	• Improved seaport access
Benefits to society	• Low environment impacts • Job opportunities • Regional development	• Low environment impacts • Job opportunities • Regional development	• Low environment impacts

Source: (Roso et al., 2004).

Table 7 summarises the types of dry ports by location and function. In their assessment of distant dry ports, Beresford et al. (2009) further identify two more types of dry ports namely city dry ports and border dry ports. City dry port refers to dry ports located in cities far away from the seaport. City dry ports, by virtue of long distance from seaport require substantial amounts of investment. Moreover, long distance to seaport may result in poor synchronisation between seaport and dry port. This may damage shippers' goodwill in the service (Beresford et al, 2009).

A border dry port refers to a dry port located in a border city (Beresford et al,. 2012, p. 83). The major functions of border dry ports are transhipment and customs clearance service. The authors explain that, in China, border dry ports act as intermodal centres connecting different hinterland locations (p. 83). To summarise, a border dry port's functions include provision of:

1. Transhipment port for cargo to and from LLCs and other inland locations.
2. Customs clearance service centres. All border crossing points for Zimbabwe, including Beitbridge and Mutare offer customs clearance services.
3. Special geographic setting of border cities, easily accessible from both mainland industrial cities and seaports. Put into context, Zimbabwe is a transit country for cargo to and from Zambia and DRC, giving it the special regional setting.
4. Railway connectivity. In the case of Zimbabwe, both Beitbridge and Mutare have rail connections with the seaports of Beira, Maputo and Durban as well as other South African ports like Richards Bay.

Border dry ports act as multimodal centres providing freight distribution to many cities in the hinterlands (Beresford et al., 2012). A border dry port must also serve the following purposes:

- Work synchronously with the seaport through the connectivity of an efficient mass means of transport, that is to say, high speed rail shuttle to the seaport.
- Improve logistics performances by offering efficient services. Kunaka (2013) explains that the emergence dry ports in Africa managed by logistics service providers such as the Bolloré Africa Logistics group is a notable phenomenon. The group operates a number of dry ports in West Africa such Abidjan in Ivory Coast and Tema in Ghana. The group was awarded a 20 year concession to operate a container terminal at Tema[26] (Bolloré Africa Logistics, 2012).
- Extend the hinterland of shipping companies. Evidently, the new generation of dry ports is managed by shipping lines, terminal operators and third party

[26] MPS terminal, Port of Tema, Ghana.

logistics service providers (3PL). An example of this function is in Ethiopia where Ethiopian Shipping Lines is responsible for the cargo operations at Modjo dry port (Kunaka (2013, p. 100). Therefore, dry ports also increase shipping lines' market share in the supply chain (Kunaka, 2013).

- Consolidate container flows and redistribute cargo considering both full container loads (FCL) and less-than container load (LCL) services. Most shippers in LLDCs are predominantly small and use LCL services. At dry ports, containers are stuffed or stripped. Similarly, small parcels can be packed or repacked in containers for shipment to final buyers thereby optimising container redeployment (Kunaka, 2013). Resultantly, dry ports can significantly reduce empty container movement between seaport and hinterland by approximately 30 % (TransBaltic, 2012, p. 21).
- Facilitate regional economic integration through regional trade. UNCTAD (2013) highlighted that the average share of intra-African exports between 2007 and 2011 was 11% compared with 21% in Latin America, 50% in Asia and 70 % in Europe. Dry ports could steer regional economic integration and help solve these regional trade disparities (UNCTAD, 2013; Jorgensen, 2000, p. 3; Kimenyi et al., 2012).

2.6 Dry port governance and policies

It is not uncommon to have public ownership and private operation on a common user basis (UNCTAD, 1991). Usually, a dry port requires regional agreements between two or more countries through bilateral, trilateral or multilateral agreements. UNCTAD emphasises that the whole system should avoid the exploitation of dry port resources by exclusive parties and the creation of cartels. FDT (2009) outlined the possible governance for a dry port as depicted in figure 4.

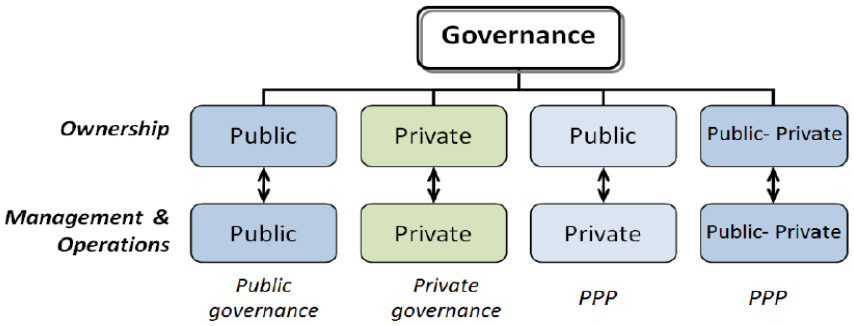


Figure 4. Potential governance models for dry ports.

Source: (FDT, 2009, p. 44).

Figure 4 illustrates possible dry port governance models. Governance can either be public governance, private governance or public-private partnerships. Each model and funding method has its advantages and disadvantages. The private sector normally does not invest in infrastructure because of the huge capital cost involved. Therefore, the government has the obligation to develop dry ports while the private sector assumes operations under concession. PPPs have the greatest flexibility and are, therefore, usually preferred over the other options.

Dry ports are an integral component of a modern logistics chain. Therefore, a number of policies from various sectors influence their development and operation. ESCAP (2010b) clarifies the linkages between dry ports and various sectoral policies (as cited in Regmi, 2012). The sectoral policies are highlighted in Figure 5.

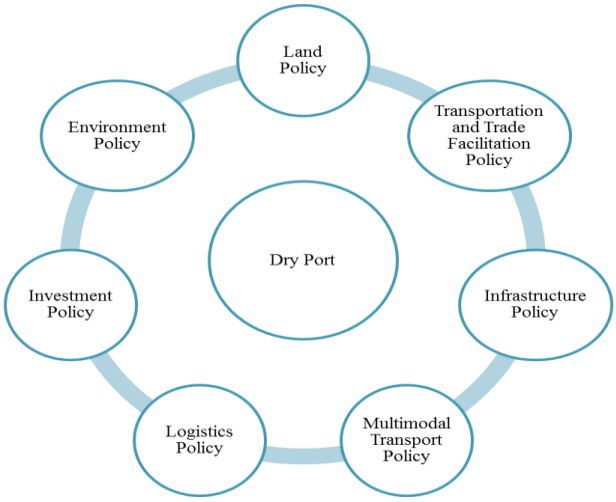


Figure 5. Sectoral policies that affect dry ports.
Source: (Regmi, 2012).

Figure 8 illustrates that an array of policies affect a dry port. These include transportation and trade facilitation policy, multimodal transport policy, land policy and environment policy to name a few.

In short, dry port development should be done in liaison with all stakeholders in LLCs and the neighbouring coastal States. This is vital to ensure satisfactorily formulated policies effective for the development, management and efficient operation of dry ports. Moreover, effective implementation of international conventions and regional agreements on transport and trade facilitation are helpful (Delmas Marketing, 2011). These agreements must involve regional technical experts on transport such as transport research institutions, public transport bodies and freight forwarders associations (UN-OHRLLS, 2012) .

2.7 Dry port facilities and operational configuration

UNCTAD, (1991) outlines the minimum dry port facilities. These may include customs and clearance services, warehousing and marshalling yards as highlighted in Figure 6. In addition, a reliable and efficient information and communication system is an integral part of the dry port infrastructure (UNCTAD, 1991).

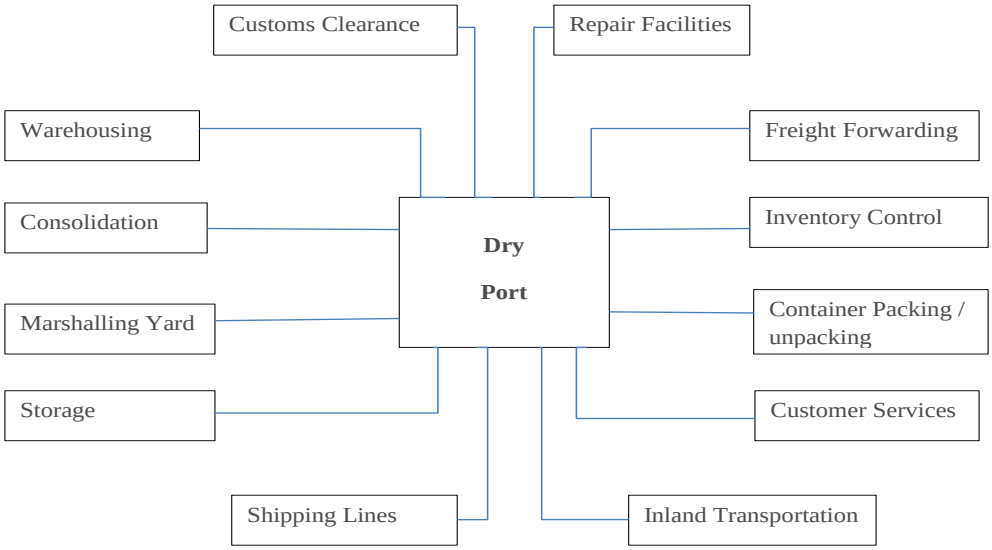


Figure 6. Functional structure of dry ports.
Source: (UNCTAD, 1991).

Figure 6 summarises the functional structure of a dry port according to UNCTAD (1991). As shown, facilities include storage, container yards and repair facilities. The stakeholders include customs, freight forwarders and shipping lines.

Roso (2008) explained that a number of factors and actors influence the development and success of dry ports. The author outlines the actors in dry port investment as seaports, shipping lines, shippers, rail operators, road operators and society. The factors that affect dry ports are infrastructure, land use, regulation and environment (Roso, 2008). These are outlined in Figure 7.

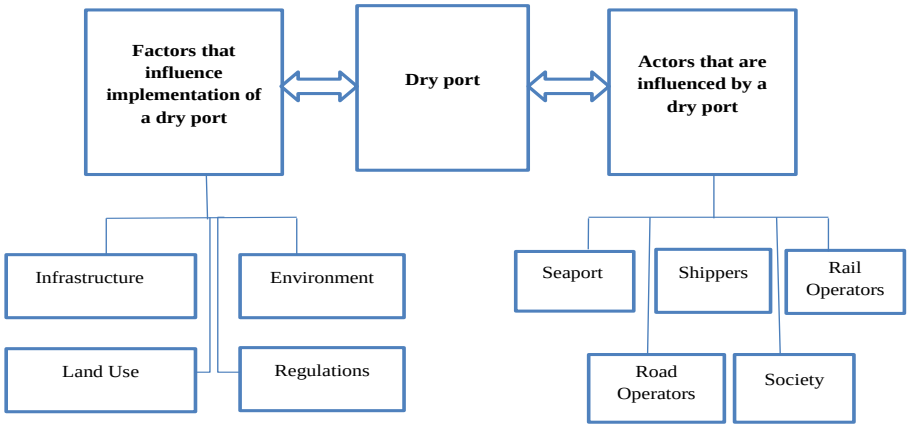


Figure 7. Factors and actors that affect dry ports.
Source: (Roso, 2008)[27].

Figure 7 highlighted the factors that influence dry port implementation. Regmi (2010), in his functional structure of a dry port, populates stakeholders around the dry port. The set of stakeholders includes shipping lines, banks, multimodal transport operators (MTOs), terminal operators and customs (Regmi, 2010). The authors explained that each party has clear-cut roles and responsibilities in the operation of a dry port. For instance, banks provide financial services while customs deliver clearing services.

According to research, there is not one agreed design for a dry port since a dry port differs from place to place, region to region and country to country. However, a potential design for a dry port is shown in appendix H.

[27] Factors influencing implementation of a dry port as published in International Journal of Physical Distribution and Logistics Management (IJPDLM), Issue 10, Volume 38.

2.8 Dry port location analysis

Choosing the correct type of dry port location requires an analysis of the appropriate factors in order to guarantee dry port success. In Table 8, UNCTAD (1991) outlines the factors to consider in identifying the optimal dry port location.

Table 8: Optimal dry port location factors

Location factor	Reference points
Traffic flow between inland centres and sea ports.	Types of commodities transported, directional split between exports and imports, the proportion between LCL and FCL, the percentage of containerised cargo, future trade flow forecast, the relative location of inland trade centres.
Modes of traffic available, network type and corridor capacity.	Road network analysis, rail network analysis, corridor capacity.
Dry port impact on reduction of distances, prices per ton kilometre or price per box per kilometre.	Percentage reduction in ton kilometres and total reduction in transportation costs.
The type of transport infrastructure in the vicinity of the dry port.	Road and rail network and airports. Warehousing facilitates.
Future development	Expansion possibilities, land, industrial zones, logistics zones.

Source: (UNCTAD, 1991).

Table 8 outlines the factors to consider in identifying the optimal dry port location. Supporting the same literature, TransBaltic study (2012) explained the dry port location factors as road and rail connections, geotechnical issues and regional land use plans (TransBaltic, 2012). In the case of Zimbabwe, both the border posts of Beitbridge and Mutare are strategically located in border cities along logistics corridors with high traffic. This makes the border cities suitable for dry ports. Nevertheless, every dry port is unique and there is no standard design (Roso, Woxenius, & Olandersson, 2006, p. 11)

2.9 Challenges for LLDCs when implementing dry ports

LLDCs may face numerous challenges when implementing dry ports. Firstly, the dry port might increase transport costs in the logistics chain if charges are too high or institutional barriers are not revised, resulting in operational inefficiencies. Inefficiencies eventually decrease the total throughput, leading to dry port failure.

LLDCs must minimise both physical and non-physical barriers to trade. If not, the dry port may fail to attract customers and promote the modal shift of cargo from road to rail. Therefore, the quality of institutions is import for dry port success.

In addition, a dry port may fail to generate the critical volumes of cargo required to be a viable dry port as revealed by Roso et al. (2004). Roso asserted that the dry port throughput should not fall below half the minimum annual volume of 20,000 TEU; i.e., 10,000 TEU. If it does, then the dry port will have problems of viability (Roso et al., 2004). Moreover, to be viable, a dry port must generate volumes sufficient to provide a daily train service.

If a dry port is not initially strategically located because of say political reasons, it may end up being a white elephant. Ritten (1998) expressed that a key challenge is that future shipments that will pass through the dry port cannot be pre-determined with certainty so as to establish the viability of the dry port (as cited in Roso, 2008).

The possible challenges for LLDCs also include the following:

1. Long distance between dry port and sea port may result in poor synchronisation of services between the two supply chain nodes (Beresford et al., 2012).
2. Shippers may have low confidence in dry port reliability and efficiency from the onset, sabotaging the system. For this reason, a rigorous marketing plan is needed for the success of the dry port. Promotional activities must ensure coordination between dry port and seaport.
3. Road transport operators may fear losing their jobs, particularly cross-border truck drivers (Beresford et al., 2012).

4. Fewer private logistic players may be willing to partner government initiatives on dry port projects.
5. Poor infrastructure and logistics at dry ports will eventually result in long lead times in the supply chain.
6. When a dry port is located inside a landlocked country, there may be no direct agreement to allow direct transit of trains between States, as is the case in SADC at the time of writing. Kunaka (2013) pointed out that trains may have to change locomotives at borders causing significant delays (Kunaka, 2013, p. 90). The EU white paper on European Transport (2010) explained that such "ghost trains[28]" pose serious challenges as either train or locomotive have to wait for another (European Commision, 2010, p. 28).
7. Exports from LLCs are typically bulk in nature whereas imports are value added commodities. This complicated the nature of trade imbalances.
8. Other challenges are associated with security. Security is a prerequisite of a dry port. A dry port houses valuable goods for export or import or goods temporarily stored for transhipment or break bulk for re-export. Consequently, security is required (UNCTAD, 1991). A suitable level of security has to be provided. The level of security should be similar in nature to the International Ships and Ports Security Code (ISPS Code) requirements for seaports.

[28] Where locomotives or wagons wait for each other at borders.

2.10 Examples of selected dry ports

The researcher selected and studied existing dry ports in different geographic locations to understand their operations to ascertain lessons for Zimbabwe.

2.10.1 City Deep dry port, South Africa

The case of City Deep dry port in South Africa represents an example where a dry port is located in a maritime country, developed and operated by a national transport body, the South African Railways[29]. Located in the metropolitan city of Johannesburg, South Africa, the City Deep dry port was developed in 1977 by South African Railways. City Deep is by far the largest dry port in Africa (Kunaka, 2013, pp. 88-89). It is connected by both road and rail to the seaport of Durban. City Deep has both road and rail hinterland connections to inland destinations in Southern Africa, including Zimbabwe (Kunaka, 2013).

In terms of equipment, the dry port is equipped with rail-mounted gantry cranes and reach-stackers. The site has approximately 2,000 terminal ground slots for both export and import cargo and about 700 slots for empty containers (p. 88). On average, five trains travel between the dry port and the seaport per day. The train transit time ranges between 16 to 18 hours, covering a distance of 600 kilometres (Kunaka, 2013). City Deep is an example of both a distant and a city dry port.

The main challenge facing City Deep is inadequate and unreliable rail capacity to meet new growth in traffic (Kunaka, 2013). Moreover, there are delays due to rail marshalling inefficiencies as changing locomotives result in increased turnaround times (p. 88-89). In addition, there is a lack of space to handle long truck configurations which in turn creates congestion.

Poor security used to be a major problem that almost crippled the railways. Poor security caused pilferage of goods in transit and a proliferation of cargo claims. This affected customs formalities and the purpose of the dry port. Nevertheless, the security challenges have normalized and rail has become efficient (Kunaka, 2013).

[29] Now operating as Transnet Freight Rail.

2.10.2 Modjo dry port, Ethiopia

The case of Modjo dry port in Ethiopia represents a new generation of dry ports located in landlocked countries, developed by government and operated by a shipping line. Ethiopia is a landlocked country located in the heart of the Africa. The country has seven potential maritime accesses. However, because of political standoffs with Eritrea, Ethiopia cannot use Eritrean ports like Massawa. Instead, it uses the port of Djibouti[30] as its main maritime gateway despite the distance. Consequently, the port of Djibouti remains the most viable port for Ethiopia with over 80 % of the port traffic having origin or destination in Ethiopia (Bergqvist et al., 2013, p. 92). Modjo dry port is 35 kilometres from Addis Ababa, the capital city of Ethiopia (Bergqvist et al., 2013).

Modjo is managed by the Dry Port State Enterprises, an Ethiopian government owned enterprise. Cargo operations between the seaport of Djibouti and Modjo dry port are handled by the Ethiopian Shipping Lines. Consequently, traffic to and from the seaport to the dry port is required, by law, to be handled by the shipping line[31].

The government of Ethiopia planned to develop a network of dry ports throughout the country. The objective is to reduce logistics costs by consolidating traffic in regional centres. Modjo dry port officially opened in 2010 as the principal dry port for Ethiopia (Kunaka, 2013, p. 93). Upon arrival of cargo at the seaport of Djibouti, cargo is processed for transit by customs officials. Cargo is then moved to Modjo dry port for final customs clearance.

The advantages of the system are the transhipment of cargo from the seaport, reduction of container dwell times at port and reduced port charges. The challenges are monopolistic control by the Ethiopian shipping line with regard to the handling of cargo between seaport and dry port.

[30] Port of Djibouti is managed by DP World, a global terminal operator.
[31] This creates monopolistic situation with the shipping line controlling all freight movements.

2.10.3 Cikarang dry port, Indonesia

Table 9. Cikarang dry port

Name	Cikarang Dryport.
Location	Jabaleka Indusrial Estate, Java, Indonesia.
Size	Approximately 200 hectares of land.
Accessibility	Road and Railway.
Services	Export and import handling, Domestic handling, Integrated port and logistics service provider.
Capacity	Maximum capacity of 400, 000 TEUs.
Facilities	Port terminal, empty container deport, container freight station, CFS, transhipment, government service bureau, banks and insurance
Governance model	Privately controlled.
Strength	State of art information technology, logistic hub of exports and imports, domestic and global distribution, One stop service centre.
Customer base	Major shipping lines including Maersk line, MSC, MOL, CMA-CGM, K-line and China Shipping line.[32]

Source: (Cikarang Dry Port, 2014).

Table 9 condenses the findings from a review of Cikarang dry port. All documentation formalities for seaport clearance and customs are done at the dry port.

2.10.4 Eskilstuna dry port, Sweden

Table 10. Eskilstuna dry port

Name	Eskilstuna Dry port
Location	380 Km from port of Göteborg, Sweden
Size	Terminal area is approximately 9,000m^2
Accessibility	Road and Railway. Daily container trains.
Services	Export and import handling, Domestic handling, Integrated port and logistics service provider.
Capacity	Handles approximately 20, 000 TEU per year.
Facilities	Container deport with capacity of 800 TEU, terminal offices, outsourced container storage.
Governance model	Public-private partnerships.
Strength	Strategic location, cost-efficient warehousing, good infrastructure, excellent partnerships[33], flexibility and efficiency.
Customer base	Shipping lines and shippers calling at port of Gothenburg.

Source: (Roso, Woxenius, & Olandersson, 2006)**.**

Table 10 summarises a review of Eskilstuna dry port in Sweden. The dry port is a good example of a joint investment between public and private sectors.

[32] Note that shipping lines are competing in their integration along the supply chain.
[33] Partnerships include trade, industry, municipality, universities and RAILPORT Scandinavia.

2.11 Functions of selected African dry ports

The researcher identified information on the characteristics of a few African dry ports and established the functions they operationally provide. The summary is shown in Table 11.

Table 11. Functions of selected dry ports in Africa

Dry Port	Country	Year Established	Management	Main functions
City Deep	South Africa	1977	Rail Operator	1. Transhipment. 2. Customs clearance 3. Cargo consolidation and distribution
Isaka	Tanzania	1999	Public Ownership	1. Transhipment. 2. Customs clearance 3. Cargo consolidation and distribution
Mbeya	Tanzania	1986	Rail operator, PPP	1. Transhipment 2. Customs transit processing.
Modjo	Ethiopia	2010	Government Enterprise / Shipping Line	1. Transhipment 2. Customs clearance

Source: Compiled by author.

Table 11 shows a summary of a few selected dry ports in Africa. It can be concluded that in spite of different locations and governance models, transhipment and customs clearance are a common function of dry ports in Africa.

2.12 Chapter summary

The review of literature has revealed challenges facing Zimbabwe as an LLC. Subsequently, literature on dry ports demonstrated different types and functions of dry ports, and examples of established dry ports were analysed. The researcher learned from the literature that trade facilitation aims to improve efficiency by improving clearance systems and transaction costs. Dry ports expand this notion by reducing truck distances, transport costs, improving overland logistics and providing a spectrum of benefits for different stakeholders. The analysis of existing dry ports revealed transhipment and customs clearance as two important functions of dry ports.

Chapter 3: Multimodal transport system in Zimbabwe

This chapter gives a quick overview of the transportation systems in Zimbabwe and presents an illustration of the current multimodal system without a dry port and the proposed system with a dry port integrated in the transport system.

3.1 Geographic setting

There are 16 landlocked countries in Africa. Of these, six are located in the Southern Africa Development Community (SADC) namely, Botswana, Lesotho, Malawi, Swaziland, Zambia and Zimbabwe. All the six LLCs in Southern Africa are also LLDCs that have long distances to seaports and therefore rely on their coastal neighbours for maritime transport. Figure 8 shows the LLCs in Africa.

Figure 8. Landlocked countries in Africa.

Source: (Mapsofworld, 2012).

Figure 8 shows the landlocked countries in the African continent. As portrayed in the figure, Zimbabwe is one of the six LLDCs in Southern Africa. It is a wholly landlocked country with a population of 13.72 million people (CSO, 2012).

3.2 Zimbabwe's maritime transport gateways

The main seaports used by Zimbabwean shippers are the ports of Durban in South Africa, Beira in Mozambique and Walvis Bay in Namibia. Walvis Bay receives significant[34] cargo volumes. Figure 9 shows Zimbabwe's main maritime trade gateways.

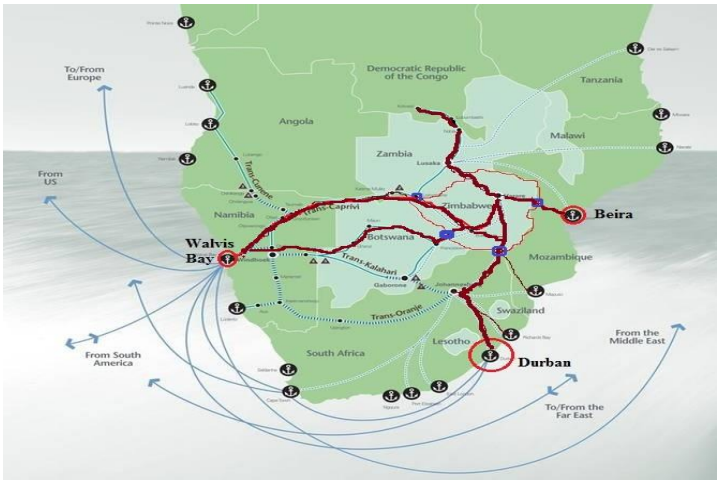


Figure 9. Zimbabwe's main maritime transport gateways.
Source: (WBCG, 2014).

Figure 9 shows the major routes used by Zimbabwean shippers to the seaports of Durban, Beira, and Walvis Bay. Durban has remained the key seaport for Zimbabwean shippers because of its efficiency. The African Bank (2010) affirms that Durban is Africa's busiest general cargo port and one of the largest and busiest container terminals in Africa[35]. Consequently, shippers from neighbouring countries transit through Zimbabwe to Durban. The shipments pass through the Beitbridge border post between Zimbabwe and South Africa.

Beitbridge border post is the busiest border crossing in Southern Africa linking South African seaports to the rest of the region. Beitbridge is located on the North-South corridor, which is also the busiest corridor in the region. The border handles both freight traffic for Zimbabwe and transit cargo for Zambia, Malawi and Democratic

[34] 2009 report showed volumes of 2500 tonnes per month.
[35] Transnet reported throughput was 2.9 million TEU in 2012.

Republic of Congo (DRC). Therefore, in spite of being landlocked, Zimbabwe is a transit State[36] for shipments with origins and destinations to Southern African countries of Zambia, DRC and Malawi.

The North-South corridor is the busiest corridor in the Southern African Region, handling most of the international seaborne trade connecting the seaport of Durban and other South African ports with the rest of the region. Notably, South Africa has remained Zimbabwe's leading trading partner as shown in Table 12.

Table 12. Zimbabwe's main trade partners

Export Partner	**Percentage Share**	**Import Partners**	**Percentage Share**
South Africa	66.7	South Africa	40.8
Mozambique	20.7	Singapore	20.5
Zambia	4.4	China	5.0
UAE	3.3	Zambia	3.0
Botswana	1.3	Mozambique	2.8
Belgium	1.1	Sweden	2.6
Israel	0.8	Japan	2.5
Namibia	0.3	Botswana	2.4
Malawi	0.3	India	2.3
Germany	0.2	UK	1.9
Others	1.0	Others	16.1
Total	**100.0**		**100.0**

Source: (ZimStat, 2014).

Table 12 shows that South Africa as the leading trading partner for Zimbabwe. UNCTAD[37] (2014) explained that Zimbabwe's exports to the rest of the world are primarily unmanufactured tobacco, pig iron, sponge iron and powder among other natural resources. Meanwhile, intra-African exports include mineral ores and mattes such as nickel ore, nickel mattes, mineral concentrates, coke and semi-cokes of coal among other minerals (UNCTAD, 2014).

[36] See UNCLOS, 1982, Article 124 (1b).
[37] UNCTAD, "Economic Development in Africa Review."

3.3 Freight Corridors in SADC

The major freight corridors that are important for Zimbabwe are the North-South corridor, the Beira Corridor and, to a lesser extent, the Walvis Bay corridor. These corridors are highlighted in Figure 10.

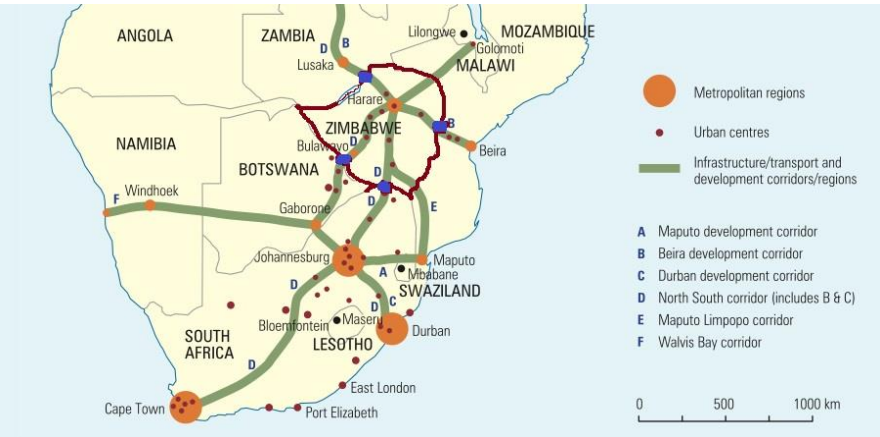


Figure 10. Development corridors in SADC.
Source: (UN-HABITAT, 2010, p. 235).

From figure 10, the major corridors in SADC in terms of importance are the North-South corridor, the Beira development corridor, the Durban development corridor, Maputo and the Walvis Bay corridor. These corridors converge in Zimbabwe. Therefore, one can conclude that Zimbabwe has a strategic position as a transit state. Harare also plays an important part as a regional inland transhipment hub. Importantly, Zimbabwe's border cities of Beitbridge and Mutare play an important role in the movement of freight in the region.

The average multimodal transport costs on the North-South corridor per container per kilometre are $1.42 for road transport, $1.20 for railway transport and $1.306 for a combination of the two modes (Freeman et al., 2001).

3.4 Transport modes and infrastructure in Zimbabwe

Zimbabwe has established road transport and rail network albeit poorly maintained. The railways in Zimbabwe are publicly owned by the National Railways of Zimbabwe (NRZ) except for the Bulawayo to Beitbridge line that is privately run by the Beitbridge-Bulawayo Rail (BBR) under a 30 year concession agreement (SARDC, 1999). Inland waterway transport is not applicable for international trade but is used for some tourism purposes at Lake Kariba and Victoria Falls[38]. Zimbabwe has no maritime claims (CIA World Fact Book, 2014). Zimbabwe's rail and road networks are shown in figure 11.

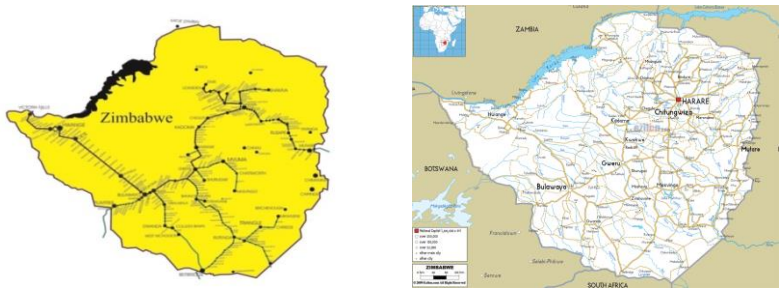


Figure 11. Zimbabwe's rail and road network.
Source: (AfDB, 2010).

Figure 11 shows the network of railways and roads in Zimbabwe. In Southern Africa, the rail gauge used is the standard 1,067 mm (3 feet, 6 inches). This standard spans across all countries in Southern Africa[39], including Zimbabwe, Zambia, South Africa, Mozambique and Botswana. Zimbabwe has a rail density of 8.77 $Km/1000Km^2$ and is ranked 51st in the world (CIA World Fact Book, 2014; SARA, 2014). Appendix C compares road to rail transport.

In terms of road infrastructure, Zimbabwe has a total of 97, 267 km of both paved and unpaved roads with a road density of 0.025 Km/Km^2. Pipeline transport covers approximately 270 km and is used to transport refined products from Mutare to Harare. Zimbabwe has a total of 17 airports with paved runways whose length varies

[38] Zimbabwe Inland Waters Navigation and Shipping Act Chapter 13:06
[39] According to SARA, standard rail gauge simplifies changing rolling stock with no need to tranship cargo.

from 914 to 3,047 metres (World Fact Book, 2013). Nevertheless, air transportation is limited in scope to compete with road and rail in freight transportation.

3.5 Analysis of transportation system

a) The traditional transportation system without a dry port.

Under the current system goods from Zimbabwe to seaports are cleared for export at borders before proceeding to seaports. Likewise, cargo arriving at the seaports is cleared for transit to borders where customs formalities are completed. Either way, trucks travel very long distances to seaports. The system is plagued with delays at the borders and congestion at the seaports as already discussed in chapter 2.The researcher estimates that the modal split between road and rail freight transport is 89% and 11% respectively as shown in figure 12.

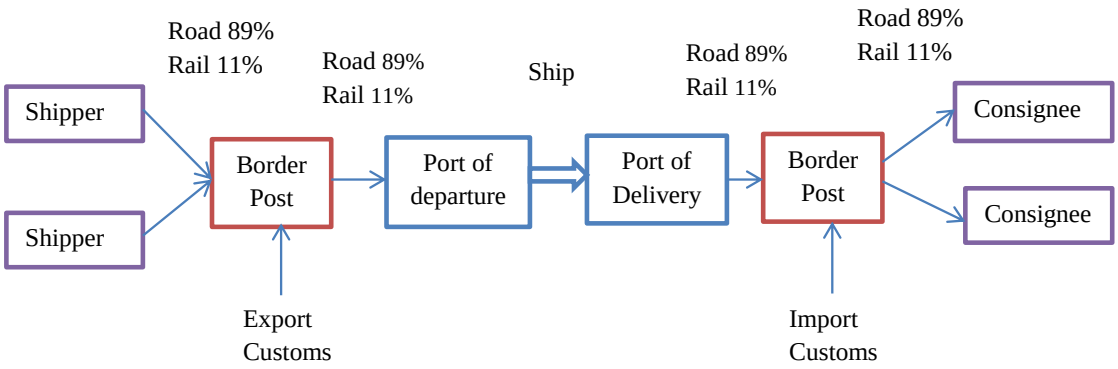


Figure 12. Transportation system without a dry port

Source: Author's own assumptions based on FDT (2009) and Roso (2008).

Figure 12 highlights that there is no transhipment at the moment and road transport is predominantly used from the shipper's premises all the way to the seaport.

(b) Transportation with a dry port.

With a border dry port introduced at the border post to replace the traditional border system, containerised, unitised and other cargoes like cars will be shifted from road to rail. A dry port shall operate as a seaport with cargo being left at or picked up from the border dry port. Therefore, the researcher expects rail freight to increase 11% to reach 70% modal share by 2030 as seen in figure 13.

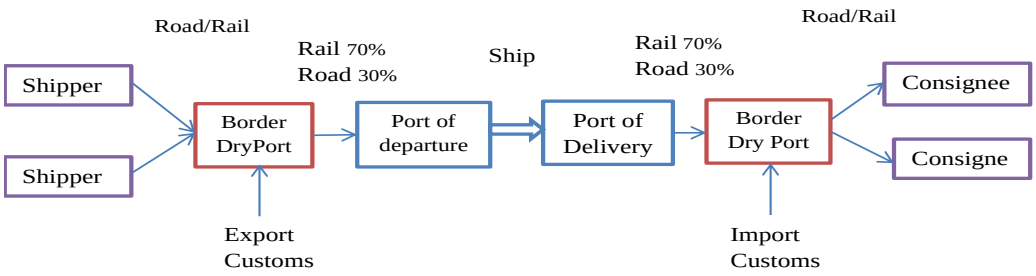


Figure 13. Transportation system with a proposed border dry port.
Source: Author's own assumptions based on FDT (2009) and Roso (2008).

Figure 13 shows that with a dry port and transhipment, rail freight will increase annual by 3.7%. Thus most trucks will not continue with the prolonged journey to seaports. Instead, rail transport will complete the long distance to seaports. The researcher adopted the concept as explained by Jaržemskis & Vasiliauskas (2007)

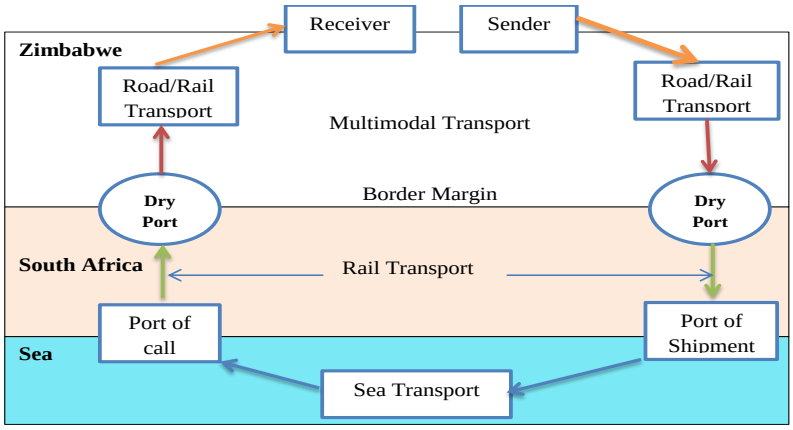


Figure 14. Dry port concept.

Source: Modified by author from (Jaržemskis & Vasiliauskas , 2007).

Figure 14 shows the introduction of a border dry port eliminating the traditional border post. Cargo left at the border dry port is shifted from road to rail. This analysis is intended to show how dry ports fit into the logistics picture.

3.6 Chapter summary

This chapter presented Zimbabwe as a transit landlocked country. Subsequently, Zimbabwe's maritime gateways were explained. Subsequently, the freight corridors important to Zimbabwe were named. Afterwards, the current system without a dry port and the proposed shipping system with a dry port were illustrated.

Chapter 4: Assessment of dry ports viability for Zimbabwe

This chapter assesses the viability of dry ports for Zimbabwe focusing on Beitbridge border post. It explains the research methodology and the data collection methods that were used. Subsequently, data collected is analysed to gather conclusions. The case of Beitbridge border post is investigated to determine its viability for a border dry port. The researcher has calculated potential financial and environmental savings that may be achieved from establishing a border dry port at Beitbridge. In addition, a cost benefit analysis and a SWOT analysis is conducted for Beitbridge border dry port. The chapter concludes by presenting the strategies for dry port implementation.

4.1 Research Methodology

The research follows a quantitative research methodology. The researcher applied quantitative techniques to investigate and analyse a case study of dry port development. Statistics were used to measure central tendencies and dispersion of variables. A cost-benefit analysis and forecast of cargo throughput was carried out to establish viability in the case of Beitbridge. A case study may be defined as an empirical investigation that examines a situation within its real-life context through the application of real life theories. Hence, the researcher wanted to establish the appropriateness of dry ports for Zimbabwe, using established dry ports literature. The researcher used a non-probabilistic convenience sampling technique to select participants due to their convenience and availability. In this case, student researchers in shipping and port management participated in the voluntary questionnaire. Later, an optimal dry port location was done using the centre of gravity methodology, as shown in appendix K.

4.2 Data collection methods

The researcher used two types of data, namely primary data and secondary data. The primary data collection method used was questionnaire. The objective of using the questionnaire was to reach a wide spectrum of participants in different geographical locations, mainly shipping and port professionals. In addition, it allowed the researcher to address research specific questions. Nevertheless, potential sources of

valuable information were beyond the reach of the researcher while some respondents did not participate due to company policies.

The researcher also used secondary data derived from books, reports, journals, articles, government gazettes, conference papers, seminar papers, business reports and other secondary data sources. Secondary data provided superior databases of information on dry ports. Besides, it would have been almost entirely unfeasible to conduct a new study on an individual research basis in a relatively short time. The advantages of secondary data are that it already has established validity and reliability of background studies, costs less and requires minimum effort on the part of the researcher. Figure 15 summarises the types of data and the data collection methods that were employed.

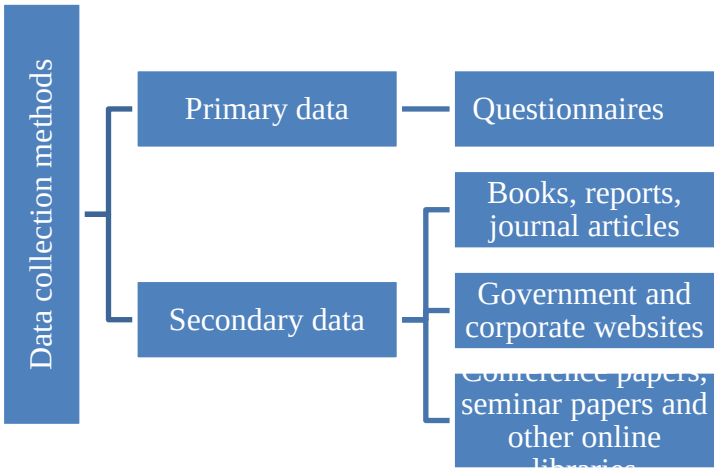


Figure 15. Data collection methods.
Source: Compiled by author.

Figure 15 summarises the types of data and data collection methods and sources used during the research. The measurement variables that were used in the research include distance between cities and seaports, transport costs, annual cargo throughput and net export volumes.

4.3 Data Analysis

The data analysis phase presents the qualitative and quantitative analysis of data gathered through both the primary and secondary data collection methods. The results from analysis are used to answer the research questions and to decide whether or not dry ports can address the challenges of Zimbabwe as a landlocked country. In total, 92 questionnaires were sent out to participants (See Appendix L). Of these only 32 were returned representing a 35% response rate as shown in Table 13.

Table 13. Analysis of dry ports benefits from questionnaire

Questionnaire Analysis							
Target sample :	91						
Total Resposes :	32						
Response rate :	35%						
Expected Benefit	**Total Responses**	**Mean score**	**Median score**	**Modal score**	**Std Dev.**	**Rank of Benefits**	**Sum**
Reduce seaport congestion	32	4.30	5.00	5.00	0.99	1.00	138
Reduce road congestion in coastal state	32	4.25	4.50	5.00	0.91	2.00	136
Reduce transport cost for LLC	32	4.10	4.50	5.00	1.00	3.00	132
Reduce Truck distances in LLC	32	4.00	5.00	5.00	1.35	4.00	131
Improve trade growth for LLC	32	3.59	4.00	5.00	1.40	5.00	115
Improve trade participation of LLC	32	3.50	4.00	5.00	1.40	6.00	114
Create jobs for LLC	32	3.10	3.00	5.00	1.40	7.00	101
Reduce road congestion in LLC	32	3.00	3.00	5.00	1.40	8.00	101
Environment benefits	32	2.80	3.00	3.00	1.25	9.00	90
Conclusion: Based on the results from analysis of questionnaire,most respondents agree to the overal importance of dry ports. The main benefit is reduced seaport congestion seconded by reduced road congestion in coastal State. Among other benefits, reduction in transport costs and truck distances were ranked 3rd and 4th respectively.							

Source: Author.

In terms of profession, nine respondents in shipping business constituted 27% of the respondents. A total of 11 respondents in port management jobs denoted 32% of the respondents. Logistics specialists represented 23% while policy and other professionals represented 10% and 8% respectively.

On answering the question on the importance of dry ports for landlocked countries, 54% said they strongly agreed that a dry port was very important, 15% agreed, 5% slightly agreed, 10% disagreed, while 16% totally disagreed. Precisely 77% confirmed they were familiar with dry ports while 23% said they were not familiar with the subject. The summary of opinions from respondents is shown in Figure 16.

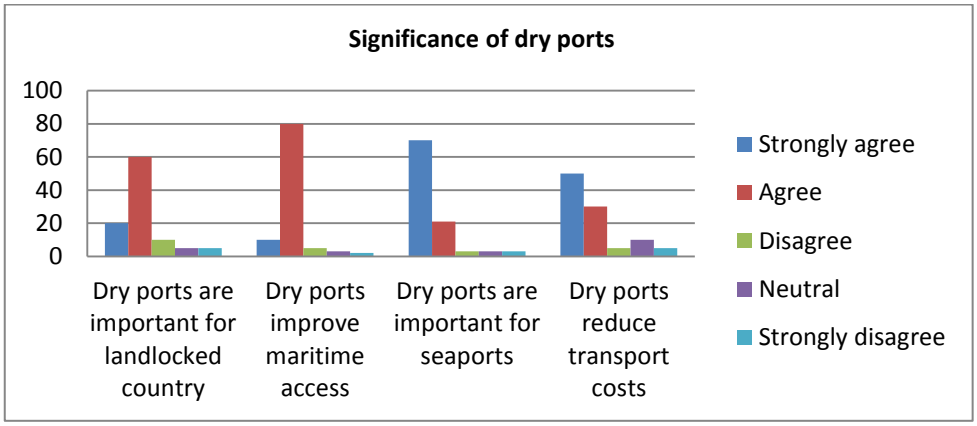


Figure 16. Respondents' views on significance of dry ports.

Source: Compiled by author.

Figure 16 shows that about 60% of respondents agree that dry ports are important for landlocked countries, 80% agree that dry ports improve maritime transport while 70% respondents strongly agreed that dry ports are important for seaports. The results on the dry port ownership are shown in Figure 17.

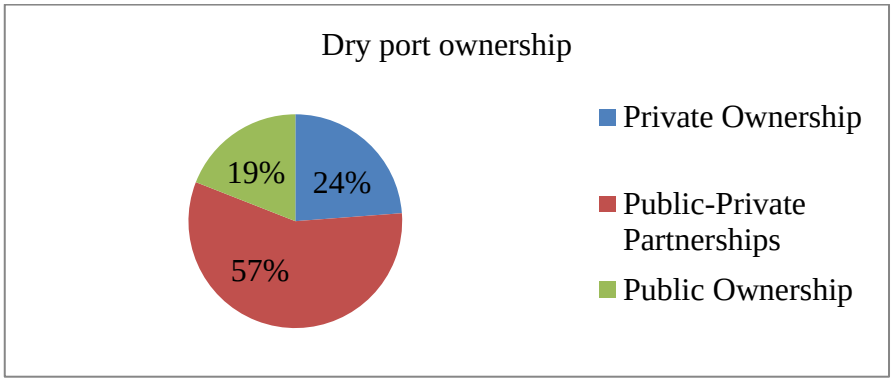


Figure 17. Respondents' views of dry ownership.

Source: Compiled by author.

On dry port ownership, 24% advocated for public ownership, 57% of the respondents supported public-private partnerships and 19% supported private ownership. About 80% of respondents said they have dry ports in their countries or have their ports linked to a dry port. On public ownership, views gathered from respondents revealed society distrust in public ownership and management.

4.4 Options to improve maritime transport access

Questionnaire participants gave their opinion on the optimal solution for LLDCs to improve access to maritime transport. Three options were suggested as:

1. Develop border dry ports.
2. Terminal (or dry port) concession at seaport.
3. Main existing system.

The costs and benefits for each option were ranked on a score from 1 to 5. The summary of findings is found in Table 14. To ensure objectivity, all options were measured against the same parameters in the questionnaire.

Table 14. Analysis of options to improve maritime access for LLCs

Option Analysis	**Cumulative costs score**	**Cumulative benefits score**	**Benefit to Cost Ratio**
Option 1 – Develop border dry port	108	96	**0.88**
Option 2 – Maintain current system	58	40	**0.69**
Option 3 – Terminal concession	128	54	**0.42**

Source: Compiled by author based on questionnaire responses.

The benefits to cost ratios were established using the formula:

$$Benefit\ to\ Cost\ Ratio = \frac{Total\ Benefits}{Total\ Costs}$$

The scores were accumulated from individual opinions in the questionnaire. Consequently, border dry ports, by virtue of having the highest benefit to cost ratio were considered to be the superior option for LLDCs.

The findings from contrasting of options produced the conclusion that dry ports present more benefits for LLCs to improve maritime transport access. Conversely, the existing system has more costs than benefits, evidenced by current problems. On the other hand, a terminal or dry port concession in a coastal country is not only pricey but has little benefit for the LLC since truck distance remains unchanged.

Given this background, the researcher established the optimal location for a dry port using centre of gravity in Appendix K. However, the location is remote from

transport infrastructure hence the researcher focused on border dry ports and analysed the attractiveness and suitability of Beitbridge as a border dry port for Zimbabwe.

4.5 Case study on Beitbridge border post

Beitbridge is located 581 kilometres away from Zimbabwe's capital city of Harare and 323 kilometres from Zimbabwe's largest and industrial city of Bulawayo. Beitbridge is approximately 1, 117 kilometres from the seaport of Durban. It is the busiest transit border for cargo from South African ports with destinations in Zimbabwe, Zambia, Malawi and DRC. The border operates 24/7 for tourists and 18 hours daily for freight vehicles. Figure 18 shows the location of the border post relative to the seaport of Durban[40].

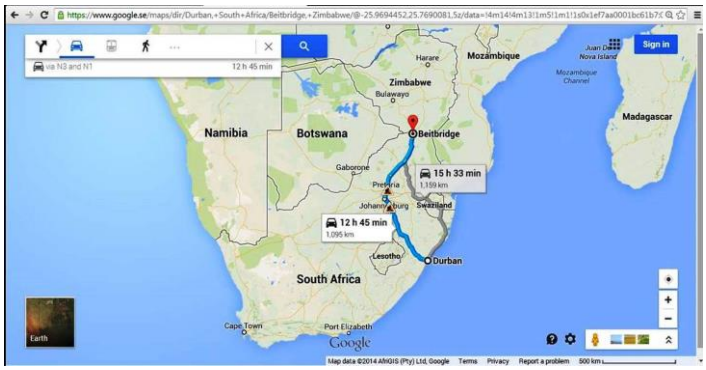


Figure 18. Location of Beitbridge border post.
Source: Google maps (2014).

Figure 18 shows the distance from Durban to the border. The Beitbridge border post is a fully developed border with services such as customs clearance, export declarations, bonded warehousing, and other facilities outlined in appendix A and B.

Beitbridge is linked to multiple seaports in South Africa and Mozambique by railway. The current problems at Beitbridge include delays and congestion as already discussed in chapter two. Therefore, the researcher proposes a border dry port, with the objective of minimising truck distances, reducing transport costs and circumventing other challenges prevalent under the current system.

[40] Note that Durban is the busiest port in the region and is used here as a reference.

The researcher analysed the future growth and competiveness of South African seaports so as to benchmark the future viability of the proposed Beitbridge dry port. This was required to establish whether seaport competition would affect cargo flows. Analysis of major South African ports by Transnet (2013) showed that port of Durban will continue to be the dominant and most favoured seaport, at least until 2042 (Transnet, 2013). Figure 19 shows this trend.

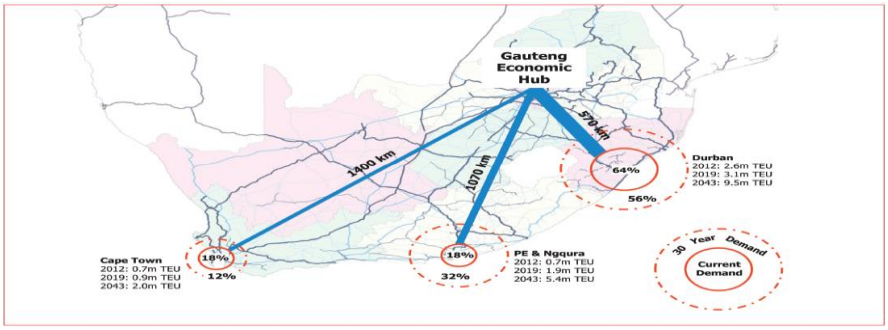


Figure 19. South African ports future demand forecast.
Source: (Transnet, 2013).

Currently, Durban has a current market share of 64%. This market share is projected to slightly fall by 8% in 30 years to reach 56% by 2042 (Transnet, 2013). To overcome competition and remain competitive, the port is continuously improving ahead of its competitors. Therefore, if competing ports do not develop to meet future expectations, then the port of Durban will remain not only dominant but may further increase its market share, reaching more regional markets. Appendix D shows a comparative analysis of competiveness of South African seaports in the region. The conclusion is that the cargo volumes passing through the border post of Beitbridge will follow the same trend since customers follow efficient ports.

4.5.1 Border delays at Beitbridge border post

Under the current system, there are challenges of congestion and delays at the border post. Fitzmaurice (2009) and Trade Mark East Africa, TMEA (2012) reports show that the border transit time is 33 hours for north-bound traffic and 45 hours for south-bound traffic (Fitzmaurice, 2009, p. 36; TMEA, 2012, p. 28). The impact is seen in increased transport costs and reduced players in transportation. Moreover, the delays

increase demurrage costs and act as tax on exports due to the additional capital expenditure on storage and transportation (Fitzmaurice, 2009, p. 29). The researcher calculated how a dry port would solve the challenges.

4.5.2 Demurrage savings with a dry port

A dry port is linked to the seaport by railway. Therefore, border standing time for trucks will be considerably reduced. Expanding on the OSBP concept from previous studies, a dry port will minimise border delays from current figures of 33 hours down to 3 hours (Fitzmaurice, 2009). Moreover, a dry port has the advantage that trucks will not continue travelling to seaports but instead, return to their origins. This implies quick truck turnaround, which, with careful planning will pay back truck operators and shippers. Fitzmaurice (2009) stated the demurrage for Beitbridge as $300 per day. The expected savings with a dry port are calculated in table 15.

Table 15. Demurrage savings with a dry port

Measurement Parameter	**Import**	**Export**
Actual dwell time at border in hours without dry port	33	45
Targeted dwell time with dry port (transhipment)	3	3
Time saved (variance) in hours (TV)	30	42
Demurrage per day	$300	$300
Demurrage per hour = $300 /24 Hours	$12.50	$12.50
Potential savings per truck per day = TV * $12.50	$375	$525

Source: (Fitzmaurice, 2009).

The conclusion from table 15 is that a truck can save $373 per day in demurrage for its import leg and $575 for its export leg. Therefore, a truck can save up-to $900 per round trip with a dry port instead of losing the same under the current system. With a 5 trip calendar month, this translates to massive savings of $54, 000 annually.

4.5.3 Environment savings with a dry port

A dry port will help to reduce the carbon footprint from trucks. To approximate social cost of carbon, a typical DAF XF 105 heavy duty vehicle (HDV) truck that has the characteristics shown in Table 16 was used

Table 16. Typical HDV characteristics

Vehicle Type	GCW (Tonnes)	Payload	Litres per 100 Km	Kg CO2 per 100 Km	Kg CO2 per Ton/Km
HDV	44	29.5	33.6	88.4	3

Source: DAF Trucks Limited (2014).

Using the vehicle characteristics in Table 16, CO_2 emission is calculated as:

The vehicle fuel consumption = 33.6 $l/100\ km$ = 0.336 *litres* per kilometre.

The CO_2 emission = $\frac{Fuel\ consumption * Kg/CO_2 \text{ per ton Km}}{Payload}$

The CO_2 emission[41] = 0.336 $l/Km * 3000 gCO_2/\ 29.5\ tonnes \approx 34.2 gCO_2/$ ton-km.

The social cost of CO_2 is $10 per tonne (EPA, 2013). The number of trucks that pass through Beitbridge border post per day is 292 trucks.[42] Therefore, if a dry port is established at Beitbridge, the CO_2[43] savings are calculated as shown in Table 17.

Table 17. Estimating the social cost of carbon savings.

Average number of trucks crossing	(From survey statistics)	292
Distance saved with dry port	(Calculated distance)	1, 117
Truck CO_2 emission	0.336*3000/29.5	34.2 gCO_2/ton-km
CO_2 saved (Distance * CO_2 emission)	1117 * 34.2	38, 201.4 g/CO_2
CO_2 reduction from a round trip	3,8201.4 tonnes * 2	76, 402.8 g/CO_2
Total trip CO_2 reduction per truck	76, 402.8 /1000 tonnes	76.40 tonnes
Mean $\mathbf{CO_2}$ value per tonne[44]	$10 per tonne	$10
Social cost of carbon per truck	76.4 tonnes * $10	$764
Total Estimated $\mathbf{CO_2}$ savings per day assuming 292 trucks.	$764 * 292	$223, 088

Source: Compiled by author based on Fitzmaurice study (2009).

[41] $\mathbf{CO_2}$varies with type of engine (e.g. Volvo, DAF, Scania), size and fuel quality used.
[42] Statistics form Limpopo Department of Road Transport (LDRT) and TLC 2009 survey results.
[43] Assuming all trucks has the same payload and fuel consumption. Fuel quality is not considered.
[44] Assuming mean value of $\mathbf{CO_2}$ is $10 per tonne as stated by US Environment Protection Agency.

From table 17, the daily social cost savings ($\mathbf{CO_2}$) value per truck is \$764. This translates to \$223, 088.00 per day for the average of 292 trucks crossing the border post. The conclusion is dry ports can reduce environment costs.

4.5.4 Benefits for road truck operators

Transporters and shippers can benefit greatly from distance reductions when a dry port is introduced. The effect of introducing a dry port on the Zimbabwean border of Beitbridge is explained by Table 18. The references are taken from Zimbabwe's three largest cities by population and freight destinations namely Harare and Bulawayo and Mutare. The reference seaport is the port of Durban.

Table 18. Impact of a dry port on truck distance

City	Distance to port of Durban	Transit time[45] (hrs.)	Border dry port (case)	Distance to dry port	Transit time (hrs.) to dry port	Truck distance saved (Km)
Harare	1,697	22	Beitbridge	580 Km	7.25	1,117
Bulawayo	1,438	15	Beitbridge	321 Km	4.01	1,117
Mutare	1, 648	20	Beitbridge	531 Km	6.64	1,117

Source: Author's own calculations.

Table 18 shows how a dry port will reduce truck distances. By minimising truck distances, transport costs are significantly minimised. FDT (2009) stated that a dry port will reduce road traffic by 30% in the transit country. More importantly, truckers have control over operating costs. Consequently, with careful planning, they can maximise profits given from the equation:

Profit margin per turnaround = $\frac{(Yearly\ revenue/turnarounds)}{(2*Variable\ Costs*Distance+Fixed\ Costs*365/turnaround)}$

By reducing truck distance, turnarounds will be increased. Since distance (devisor) is minimised, so are variable costs. Hence the profit margin is increased (Teravaninthorn & Raballand, 2008, p. 121). To sum up the project appraisal, the researcher conducted a cost-benefit analysis.

[45] The indicated transit time does not include border and in-transit delays.

4.5.5 Cost and benefit analysis

Table 19: Cost and benefit analysis for proposed Beitbridge dry port

Dry Port Project Appraisal: Project Cost -Benefit Analysis										
Assumptions										
1	Traffic is approximated at 292 daily trucks and an approximate figure of 106, 580 trucks annually									
3	No benefits are attainable within the first three years beginning 2014.									
4	The IR for NPV was approximated at 10%. Savings from accidents were not established in financial terms, therefore omitted									
5	Cost of carbon average at $10 per g/CO2 : Highway upgrade estimanted at $215, 000 per km to be done every four years.									
6	Existing rail to be used. Rail maintenance estimated at $8, 000 per km per year, EST. $4, 560, 000 for 570 km increasing 30% annually									
7	Two new locomotives (9000 HP) to be bought at price of $3.5 million each; once off investment of 7 million									
8	Road rehabilitation average cost of $215, 000 per km *570 km									
COSTS	**Annual Costs**									
Year	**Year-ID**	**Highway Rehabilitation**	**New locomotives**	**Annual Rail maintenance**	**General O&M**	**New facities, office building**	**Cost of dry ports, yards**	**Total Cost**	**P.V of Costs**	**IR**
2014	0	$122,550,000	$7,000,000	$0	$3,000,000	$60,000,000	$60,000,000	$252,550,000	$252,550,000	0.1
2015	1	$0	$0	$0	$3,000,000	$90,000,000	$90,000,000	$183,000,000	$166,363,636	
2016	2	$0	$0	$0	$3,000,000	$0	$0	$3,000,000	$2,479,339	
2017	3	$0	$0	$4,560,000	$3,000,000	$0	$0	$7,560,000	$5,679,940	
2018	4	$159,315,000	$0	$5,928,000	$3,000,000	$0	$0	$168,243,000	$114,912,233	
2019	5	$0	$0	$6,338,400	$3,000,000	$0	$0	$9,338,400	$5,798,412	
2020	6	$0	$0	$6,461,520	$3,000,000	$0	$0	$9,461,520	$5,340,781	
2021	7	$0	$0	$6,498,456	$3,000,000	$0	$0	$9,498,456	$4,874,210	
2022	8	$207,109,500	$0	$6,509,537	$3,000,000	$0	$0	$216,619,037	$101,054,379	
2023	9	$0	$0	$6,512,861	$3,000,000	$0	$0	$9,512,861	$4,034,382	
2024	10	$0	$0	$6,513,858	$3,000,000	$0	$0	$9,513,858	$3,668,004	
2025	11	$0	$0	$6,514,157	$3,000,000	$0	$0	$9,514,157	$3,334,654	
2026	12	$269,242,350	$0	$6,514,247	$3,000,000	$0	$0	$278,756,597	$88,820,443	
2027	13	$0	$0	$6,514,274	$3,000,000	$0	$0	$9,514,274	$2,755,946	
2028	14	$0	$0	$6,514,282	$3,000,000	$0	$0	$9,514,282	$2,505,408	
2029	15	$0	$0	$6,514,285	$3,000,000	$0	$0	$9,514,285	$2,277,644	
2030	16	$350,015,055	$0	$6,514,285	$3,000,000	$0	$0	$359,529,340	$78,244,060	
Total P.V of Costs									**$844,693,471**	

BENEFITS							
Year	**Year-ID**	**Shipper transprt cost savings**	**Demurage Savings**	**Social costs of carbon Savings**	**Transit time savings**	**Total Benefits**	**P.V of Benefits**
2014	0	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2015	1	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2016	2	$0.00	$0.00	$0.00	$0.00	$0.00	$0.00
2017	3	$24,892,836.48	$95,922,000.00	$80,311,680.00	$47,304,000.00	$248,430,516.48	$186,649,524.03
2018	4	$24,892,836.48	$95,922,000.00	$80,311,680.00	$47,304,000.00	$248,430,516.48	$169,681,385.48
2019	5	$24,892,836.48	$95,922,000.00	$80,311,680.00	$47,304,000.00	$248,430,516.48	$154,255,804.98
2020	6	$24,892,836.48	$95,922,000.00	$80,311,680.00	$47,304,000.00	$248,430,516.48	$140,232,549.98
2021	7	$24,892,836.48	$95,922,000.00	$80,311,680.00	$47,304,000.00	$248,430,516.48	$127,484,136.35
2022	8	$24,892,836.48	$95,922,000.00	$80,311,680.00	$47,304,000.00	$248,430,516.48	$115,894,669.41
2023	9	$24,892,836.48	$95,922,000.00	$80,311,680.00	$47,304,000.00	$248,430,516.48	$105,358,790.37
2024	10	$24,892,836.48	$95,922,000.00	$80,311,680.00	$47,304,000.00	$248,430,516.48	$95,780,718.52
2025	11	$24,892,836.48	$95,922,000.00	$80,311,680.00	$47,304,000.00	$248,430,516.48	$87,073,380.47
2026	12	$24,892,836.48	$95,922,000.00	$80,311,680.00	$47,304,000.00	$248,430,516.48	$79,157,618.61
2027	13	$24,892,836.48	$95,922,000.00	$80,311,680.00	$47,304,000.00	$248,430,516.48	$71,961,471.46
2028	14	$24,892,836.48	$95,922,000.00	$80,311,680.00	$47,304,000.00	$248,430,516.48	$65,419,519.51
2029	15	$24,892,836.48	$95,922,000.00	$80,311,680.00	$47,304,000.00	$248,430,516.48	$59,472,290.47
2030	16	$24,892,836.48	$95,922,000.00	$80,311,680.00	$47,304,000.00	$248,430,516.48	$54,065,718.61
Total P.V of Benefits							**$1,512,487,578.24**
		.					
Conclusions							
1	The Benefit to cost ratio = PV Benefits / PV costs				**1.79**		
2	The net econmic benefit is approximately $660m						
3	Conclusion: Based on the net discounted cashflows, project is viable.						

Source: Author's own calculations based on approximate figures.

The net present value (NPV) of the project was calculated using the formula for a series of cash flows as:

$$NPV = PV_1 + PV_2 + PV_3 + \cdots PV_n \;=\; NPV = \sum_{t-0}^{n} \frac{CF}{(1+k)^t},$$

where PV is present value and CF is the cumulative cash inflows and outflows.

The benefit to cost ratio is 1.79, hence the project is consumable. This result means that the project IRR is 79% in 16 years with a net economic benefit of approximately $660 million. Therefore, the return per year is roughly 5%. Zimbabwe can expect to recoup a whopping $33 million per year as logistics savings from dry ports.

In addition to the highlighted benefits, other savings are obtained through in-transit inventory cost reductions, reduction in road accidents and job creation as already discussed. Moreover, for trucking companies, savings are obtained from optimization of transportation leading to reduced operating costs and downsizing of drivers since distance is significantly reduced. Export led growth will also be achieved as justified by analysis of the GDP formula:

$$GDP = G + I + C + (X - M).$$[46]

Dry ports improve net exports $(X - M)$, thus increasing the trade component of GDP. Consequently, considering stability in population, the increase in GDP improves the GDP per capita of an LLC. Moreover, trade competitiveness is also enhanced.

Further to the cost benefit analysis, the researcher went on to establish the annual freight throughput at Beitbridge in order to make an approximate future forecast of box cargo.

[46] G= government spending, I=Gross private investment, C= private consumption and (X-M) = Net exports

4.5.6 Freight throughput at Beitbridge border post

The researcher utilised freight statistics from the Limpopo Department of Roads and Transport, LDRT (2014). The annual breakdown of statistics of cargo volumes freight traffic flow is now discussed. From LDRT, the statistics of the actual traffic flow trend are shown in Figure 20.

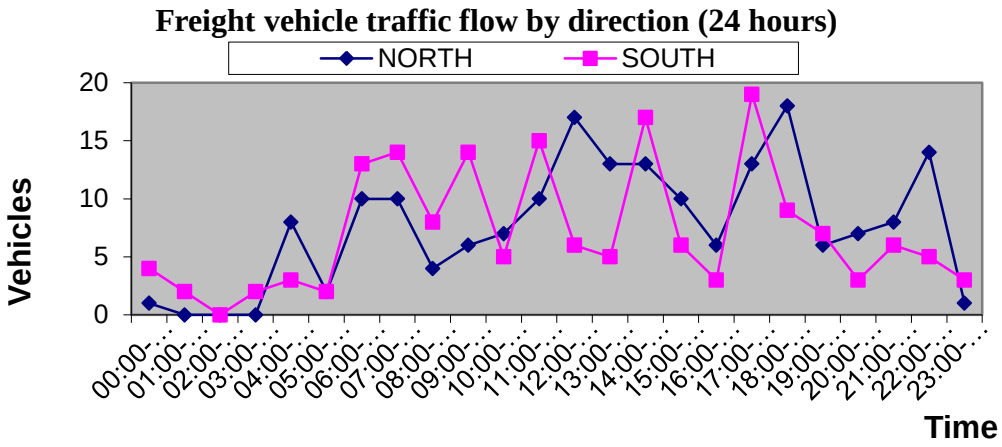


Figure 20. Establishment of freight vehicles per day. Source: (LDRT, 2013).

Figure 20 shows the traffic flow statistics at Beitbridge, with an average total of 292 trucks per day (LDRT, 2013). The Beitbridge border post freight statistics and cargo modal split is summarised in Table 20.

Table 20. Establishment of freight volumes

Road Freight	**Statistics**
Average freight vehicles per day	**292**
Estimated annual road freight (million tonnes)	**2, 523, 900**
Rail Freight	
Estimated annual rail freight (million tonnes)	**1, 260, 000**
Total annual freight (million tonnes)	**3, 783, 900**

Source: (LDRT, 2013).

Table 20 highlights that Beitbridge border post handles a total of 3.7 million tonnes per annum. Of this, approximately 2, 523 900 tonnes is road freight for both export and import[47]. Container freight is 6 % of road freight representing 151,434 tonnes.

[47] Cargo split between road and rail is 67% and 33% respectively. In 2000, Jorgensen proclaimed cargo split to be 60% and 40% for road and rail transport respectively.

The annual rail freight is approximately 1, 260 000 tonnes. Table 21 shows the container freight statistics by direction for both export and import.

Table 21. Container freight statistics by direction

Total container quantities, by vehicle numbers and TEU Count					
	By vehicle count FEU/TEU			**By actual TEU Count**	
Direction	North Bound	South Bound		North Bound	South Bound
Annual totals	**4200.0**	**2700.0**		**8400.0**	**5700.0**

Source: (LDRT, 2013).

It was noted that due to different truck configurations, some vehicles carry one TEU and one FEU while other carried only one TEU or one FEU. Based on the actual TEU count statistics in Table 21, the total actual container traffic is 14,100 TEU. Imports are at approximately 68% while export constitutes 32% of the trade. The trade imbalance is roughly 19%. This variance constitutes the trade imbalance and also empty containers. The generation of empties is calculated as:

$Empty\ Containers = Imports - Exports$ (UNCTAD, 1991)

$= 8,400 - 5,700\ (TEU)$

$= 2,700\ TEU\ as\ empty\ containers$

Consequently, after considering empties, the approximation of annual containerised cargo throughput for the proposed Beitbridge border dry port is shown in Table 22. Rail container freight throughput was approximated to be 6% of rail traffic, i.e. 150,000 tonnes.

Table 22. Annual TEU throughput estimate

	Import (TEU)	**Export** (TEU)	**Total** (TEU)	**Empties** (Imbalance)	**Throughput** (Inc. empties)
Road container freight	8, 400	5, 700	**14, 100**	2, 700	**16, 800**
Rail container freight	6, 181	3, 819	**10, 000**	1, 900	**11, 900**
Totals	**14, 581**	**9, 319**	**24, 100**	**4, 600**	**27, 700**

Source: Author.

Table 22 shows that the annual containerised throughput at Beitbridge by TEU count including empties is 27, 700 TEU. According to Roso et al. (2004), a viable dry port

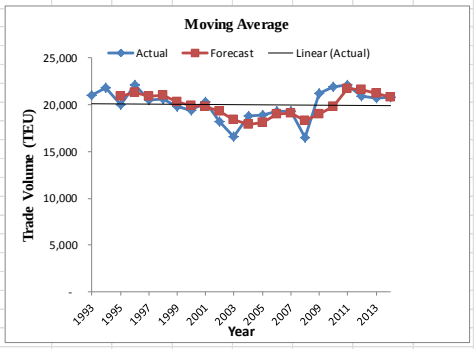
should have a throughput between 15,000 and 20,000 TEU per year (Roso et al., 2004). Next, a simple forecast of cargo throughput was prepared.[48]

4.5.7 Forecasting containerised freight throughput

The forecast of containerised freight throughput is shown in Figure 21

FORECAST OF CONTAINER THROUGPUT

THROUGHPUT		FORECASTING					
Year	Annual TEU	Naïve Forecast	3YR.MA	EXP. FORECAST	G.R		
1993	21,000			21,000	0.5		
1994	21,840	21,000		21,420			
1995	20,040	21,840	20,960	20,730		20,960	
1996	22,080	20,040	21,320	21,405		21,320	
1997	20,540	22,080	20,887	20,973		20,887	717.444
1998	20,580	20,540	21,067	20,776		21,067	558.1583
1999	19,840	20,580	20,320	20,308		20,320	442.5013
2000	19,380	19,840	19,933	19,844		19,933	507.7474
2001	20,280	19,380	19,833	20,062		19,833	495.3413
2002	18,220	20,280	19,293	19,141		19,293	743.3558
2003	16,600	18,220	18,367	17,871		18,367	1221.02
2004	18,840	16,600	17,887	18,355		17,887	1314.281
2005	18,860	18,840	18,100	18,608		18,100	1239.295
2006	19,300	18,860	19,000	18,954		19,000	724.901
2007	19,260	19,300	19,140	19,107		19,140	476.7949
2008	16,460	19,260	18,340	17,783		18,340	1101.333
2009	21,200	16,460	18,973	19,492		18,973	1683.928
2010	21,920	21,200	19,860	20,706		19,860	2060.424
2011	22,120	21,920	21,747	21,413		21,747	1764.561
2012	20,880	22,120	21,640	21,146		21,640	1285.895
2013	20,740	20,880	21,247	20,943		21,247	569.7043
2014	20,800	20,740	20,807	20,872		20,807	527.3694
2015	19,922			20,397			
2016	20,002			20,199			
2017	20,197			20,198			
2018	20,265			20,231			
2019	20,555			20,393			
2020	20,761			20,577			



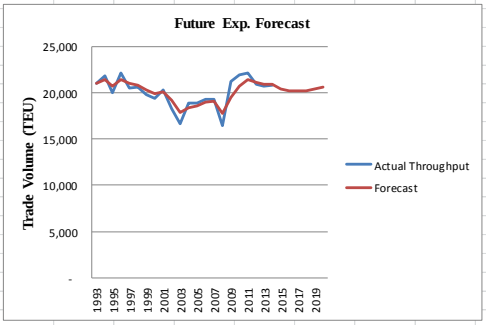


Figure 21. Forecast of containerised freight throughput.
Source: Author's own calculations.

The forecast of container trade with a dry port shows traffic will improve annually by 6% from the current average of 20,000TEU to reach figures slightly above 25, 000 TEU by 2017. The reasonable freight volumes encouraged the researcher to conduct a SWOT analysis for Zimbabwe's strategic border cities of Beitbridge and Mutare to support the findings. The provisional SWOT analysis for Mutare is included in appendix I. Although Mutare has the superlative dry port location, the freight statistics could not be ascertained at the time of research.

[48] The data used is approximate and may differ significantly.

4.5.8 SWOT analysis for Beitbridge

SWOT analysis seeks to establish the strength, weaknesses, opportunities and threats associated with a project. Strengths are those internal qualities that inspire success of the dry port development. Weaknesses are negative factors that destabilise project success. The opportunities and threats are external factors that can either assist or destabilise project success. Figure 22 shows Zimbabwe's strategic position as a transit State[49] in the region.

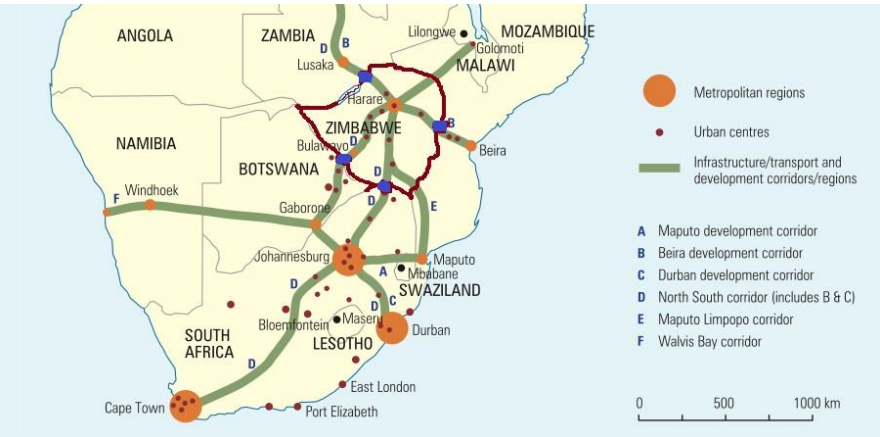


Figure 22. Strategic position of Zimbabwe in SADC.
Source: (UN-Habitat, 2010).

Figure 22 shows Zimbabwe's strategic position in the region. Beitbridge's attractiveness as a border dry port is buoyed by its strategic location and ability to serve multiple ports in South Africa and Mozambique. In addition, the majority of the seaports are highly efficient. Therefore, connecting the Beitbridge border directly to seaports through a dry port is a ground-breaking way of transporting goods which has cost cutting benefits. Table 23 summarises the SWOT matrix for Beitbridge.

[49] See UNCLOS 1982, Article 124 (1b).

Table 23. SWOT analysis for proposed Beitbridge dry port

Strength	Weaknesses	Opportunities	Threats
Beitbridge is the shipper's favourite route.	Long distances to seaports.	Trade-led economic growth.	Competition from nearby seaports.
The border is strategically located on North-South Corridor.	Lack of local technical expertise.	Wider hinterland access will improve government revenue.	Competition from existing dry ports.
Large cargo volumes from local shippers and neighbouring countries.	Congestion and border delays.	Improved multi-modal transport connectivity.	Threats of resistance from coastal country.
Good road and rail infrastructure with links to both seaports and inland destinations.	Under maintained rail and road infrastructure.	Improved maritime transport access and intra-regional trade.	High freight rates in landlocked country and trade imbalances.
Established facilities like customs clearing and bonded warehouses.	Poor financing of facilities. Over reliance on road transport.	Improved control through IT e.g. ASYCUDA, single window system.	No specific regional legislation on dry ports.
Adequate land available, room for growth of logistics centres.	High congestion along the corridors.	Land use opportunities e.g. new logistics parks.	High costs of inland transportation.
Abundant skilled human capital.	Slow project implementation by government.	New sources of employment for locals.	Smuggling and drug trafficking through freight vehicles.
Regional security and stability.	Poor enforcement of codes e.g. ISPS, IMDG Code.	New business models. Possible financing through PPPs.	Human trafficking challenges, Weak enforcement of environment laws.

Source: Compiled by author.

Table 23 shows the SWOT analysis for Beitbridge. Among other paybacks, a dry port at Beitbridge will help Zimbabwe to improve maritime access and boost trade. Other benefits include minimizing threats of smuggling through freight vehicles since cargo is transhipped to rail. In conclusion, the SWOT analysis justifies Beitbridge as a viable dry port location, having profound strength and opportunities sufficient to sustain dry ports and steer trade and economic development.

4.6 Dry port planning and implementation strategy

4.6.1 The balanced scoreboard

Given that a dry port is feasible, strategic planning for a dry port is necessary. According to FDT (2007) strategic planning tools such as the balanced scoreboard by Kaplan and Norton (1996) may be used for the development of a dry port (pp. 56-59). The balanced scoreboard approach is shown in Figure 23.

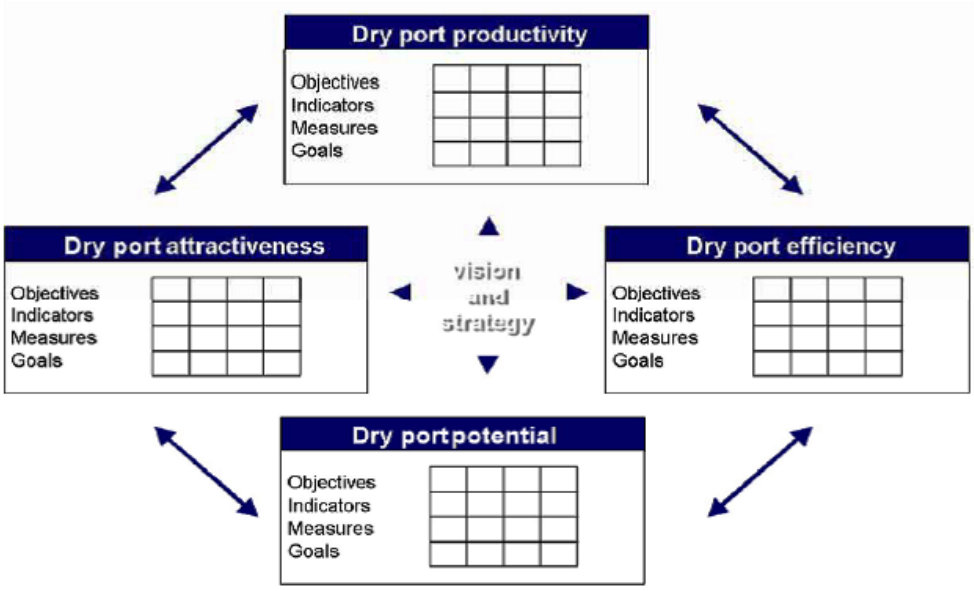


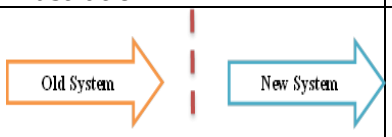
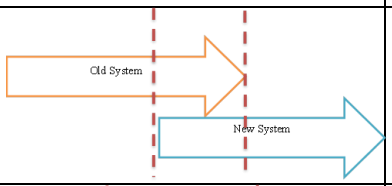
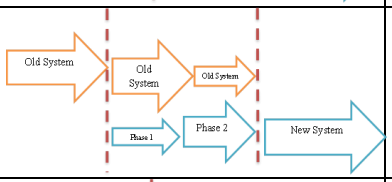
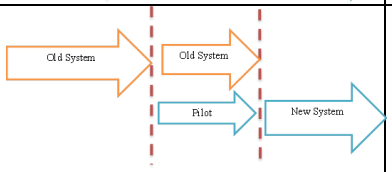
Figure 23. The balanced scoreboard approach.
Source: (FDT, 2007).

Figure 23 shows the balanced scoreboard for a dry port. The scoreboard translates the dry port vision and strategy into four perspectives namely dry port productivity, attractiveness, potential and efficiency. Each perspective should have objectives, indicators, measures and goals. For example, dry port objectives could include improving transport infrastructure and increasing FDI. Moreover, there should be a balance between perspectives. A sustainable balanced scoreboard should cover all important areas of economic, social, technical, environmental and operational feasibility (FDT, 2007, pp. 56-64). Upon success, a dry port can be implemented using changeover methods suggested in Table 24.

4.6.2 The changeover methods

The decision criteria for selecting a changeover method may be depend on factors such as the governance model and anticipated throughput which is often unique to each dry port. Table 24 summarises the different changeover methods.

Table 24. Dry port implementation methodology

Method	Illustration	Advantages	Disadvantages
Direct changeover		A direct changeover method offers the advantage that it takes the minimal time and effort to implement.	If the new system fails, reverting back to old system is hard and costly.
Parallel changeover		The old system acts as backup in the event that the new system fails. Also, both systems can be compared.	Simultaneous operation of both operations is timeous and expensive.
Phased changeover		The new system can be carefully observed with low costs in staff training and resources. Also, employees get used to the new system.	Slow project implementation. Also, results can be catastrophic if system fails.
Pilot changeover		The pilot project is inexpensive and can be successfully run as a trial for the old system. Moreover, old system is not affected by the pilot trials.	The drawback is slow implementation.

Source: Compiled by Author.

As a recommendation, TransBaltic Project (2012) explained that it is advisable to begin dry port operation with existing infrastructure in phases. Satisfying the condition where shippers begin to leave and collect their cargos is not easily achieved, especially in regions that have relatively low population (p. 5). Therefore, phased changeover method or pilot projects may give positive results.

4.7 Chapter summary

This chapter covered the research methodology and analysis of data. Both primary and secondary data were analysed. The case of Beitbridge was investigated for possibility of a dry port. This led to the presentation of a cost benefit analysis, SWOT analysis and testing dry port using the balanced scoreboard approach. Lastly, alternative changeover methods were summarised.

Chapter 5: Conclusions

This chapter concludes the study. To begin with, the research findings are presented. These include findings from the analysis of challenges faced by Zimbabwean shippers and the benefits accrued from border dry ports. Subsequently, the research implications are outlined. Later, the conclusions and recommendations are explained, giving suggestions on the way forward.

5.1 Research findings

Like many other developing landlocked countries, Zimbabwe experiences many challenges along the journey to seaports. The problems are summarised in Table 25.

Table 25. Challenges faced by Zimbabwe

Challenge	Derivation of challenge
Long distance travelled to seaports	Landlocked country, remoteness from seaport
High transportation costs	Long distances to seaports, long transit time, poor logistics.
Long transit time	Long distance, border delays, in-transit delays, illicit deals, tolls gates and road blocks
Supply chain uncertainties	Long time to export and import.
Border delays	Lengthy customs processes, burdensome documentation, congestion and rent-seeking activities
Seaport delays	Seaport congestion, seaport inefficiency

Source: Author.

Table 25 summarises the problems faced by Zimbabwe as a landlocked country. It was discovered that Zimbabwean shippers continue to pay high transport costs despite low costs of maritime transportation. Zimbabwe is 30% less developed than it would have been had it been not landlocked (UN-OHRLLS, 2012). Moreover as an LLC, it has a low GDP per capita compared to maritime states.

Beitbridge is a strategic location for a border dry port. Border dry ports will address Zimbabwe's challenges with regard to maritime access. However, using the centre of gravity approach in appendix K, the optimal dry port location for Zimbabwe is in Harare. The location north of Chivhu represents an optimal location for a national logistics hub. The researcher also learned that border dry ports for LLCs must be

located inside the LLCs, in the closeness of the border. The findings on the benefits of border dry ports are shown in Table 26.

Table 26. Benefits of border dry ports

Benefits of border dry ports to dry port stakeholders	
Benefits to seaport	▪ Less congestion as trucks are reduced. ▪ Expanded hinterland access. ▪ Increased market share.
Benefits to seaport city	▪ Less road congestion. ▪ Less noise and air pollution.
Benefit to road operators	▪ Less time spend in congested roads and port. ▪ Improved truck turnaround times and profitability. ▪ Cutting down operating costs.
Benefits to rail operators	▪ Utilise idle capacity and gain market share. ▪ Economies of scales, increased profitability.
Benefits to shippers	▪ Improved seaport access through dry port. ▪ Transport cost savings as distance is minimised. ▪ Environment benefits though reduction of GHGs
Benefits to society	▪ New job opportunities. ▪ Less environment pollution from trucks. ▪ Economic and regional development.

Source: Author's compilation.

Table 26 summarises dry port benefits for stakeholders such as shippers, the seaports and society at large. It was found that the most leading advantage of dry ports for LLCs is the ability to reduce trucking distances and, consequently, minimise transport costs. In addition, a dry port promotes transhipment. Other benefits include the use of multimodal transport documents and IT systems such as ASYCUDA, EUROTRACE and the use of the single window system[50].

A dry port also supports the use of unified transport regimes such as the Rotterdam Rules[51]. Shippers may also ship CY/CY i.e. from Container yard to Container Yard. Both CIF and FOB consignees can receive their shipments at dry ports. Therefore, dry ports play a major logistics role in a modern integrated logistics system. The

[50] The advantages include electronic data interchange (EDI), transaction security and efficiency.
[51] Rotterdam Rules recognise through transport, extends carrier's delivery responsibility. See Art. 12. Shipping companies can issue combined or multimodal bills of lading.

analysis of data shows that freight throughput at Beitbridge justifies border dry port development as shown in the summary statistics in Table 27.

Table 27. Statistics of containerised freight throughput.

Annual Throughput (TEU)	
Mean	20,035
Median	20,410
Standard Deviation	1,579
Range	5,660
Minimum	16,460
Maximum	22,120
Sum	440,780
Count (Years)	22

Source: Compiled from author's calculations.

From the analysis of Table 27, the mean annual TEU is 20,035, the minimum is 16,460and the maximum TEU is 20,410 TEU with a standard deviation of 1, 579 TEU. Beitbridge border has total annual freight throughput of 3.5 million tonnes.

The cost-benefit analysis revealed that a dry port at Beitbridge is achievable, with a net annual return on investment of 5%. The result will be improved trade-led economic development as revealed in the analysis of net export component of GDP. Moreover, through transhipment and improved hinterland penetration, the researcher expects the share of rail freight to increase by 3% annually to reach 60% by 2020.

Despite inefficiencies and infrastructure challenges at Beira port, the researcher is optimistic that Mutare dry port is the grand dry port opportunity that would deliver enormous advantages for Zimbabwe[52]. The viability of the dry port is dependent on the port developments at port of Beira, especially with regards to compete with Durban for container freight. The key to dry port success is good railways.

To sum up the findings, dry ports are economically viable projects for Zimbabwe that not only reduce transport costs for shippers but provide many benefits for different stakeholders. Besides, dry ports will uplifts Zimbabwe's strategic position as a transit landlocked country.

[52] See appendix I

5.2 Implications

Given the outcome of the research, dry ports are viable projects that can be exploited by Zimbabwe, but with the following implications:

Dry ports will require improvements in the quality of institutions involved. Therefore, the government should involve the private sector to conduct proper economic, social, technical, environmental and operational impact assessments of dry port projects to ensure implementation success and sustainability.

A dry port at Beitbrige would pose competition to South African dry ports like City Deep. Moreover, dry ports may induce competition between seaports. Therefore, impact assessment must address both situations of inter dry port and inter-seaport competition induced by dry ports.

Another implication is that the dry port requires a multilateral policy framework between the landlocked countries and the neighbouring coastal States to ensure cooperation[53]. Moreover, a "through freight train" system will need to be agreed. Historically, through freight trains in Southern Africa have been unsuccessful (Kunaka, 2013). However, recent developments are aimed at achieving through freight trains from South Africa to DRC (Transnet, 2013).

In addition, dry ports are affected by many sectorial policies such as land use policy, environment, taxation, logistics, transportation and trade policy (Regmi, 2012). Therefore, policy inconsistencies may arise when implementing dry ports between landlocked countries and coastal States. If unaddressed, policy differences may affect trade continuity and business operations between LLCs and coastal States.

Dry port investments are capital projects which require massive financing and interplay between public and private entities. The government should encourage PPPs. PPPs may be project specific with financing options, e.g. "Build Operate Transfer (BOT)" or "Build Own Operate Transfer (BOOT)." Normally, a private consortium forms a special purpose company (SPC) to run the concession.

[53] Beitbridge border is used by South Africa, Zimbabwe Zambia, Malawi and DRC

5.3. Summary of conclusions

Chapter 1 introduced Zimbabwe as a landlocked country in Southern Africa. Afterwards, the research background was discussed, linking the challenges of LLDCs to the dry port concept. This discussion led to the statement of the research objectives and purpose of the study. The scope of the research presented the fitness of dry ports in the logistics chain. The chapter ended by presenting the research methodology and logical structure of the dissertation.

Chapter 2 examined both the comprehensive literature on the challenges faced by Zimbabwe as an LLDC and on dry ports. The analysis presented exhaustive views on the types, functions and benefits of dry ports for different stakeholders. Subsequently, case studies on dry ports were studied to understand the functional structure, challenges and operational success of dry ports in different parts of the world.

Chapter 3 discussed the current multimodal transportation system in Zimbabwe. The chapter began by presenting the geographic setting of the country as a transit LLC. Subsequently, the Zimbabwe's maritime gateways and logistics corridors were discussed. This led to the discussion of the transport modes and infrastructure in the country. The discussion culminated in the analysis of the current system without a dry port and the proposed transport system with a dry port.

Chapter 4 identified the research methodology and the data collection methods used. Subsequently, data collected was analysed to make judgement and conclusions. The case of Beitbridge border post was investigated to determine its viability for a dry port. In this context, the freight volumes at Beitbridge were analysed to establish whether or not it is viable for a dry port. The viability assessment included analysis of potential financial and environmental savings that could be achieved from establishing a border dry port at Beitbridge. In addition, a SWOT analysis was conducted for Beitbridge. The chapter concluded by presenting options for dry port planning and implementation.

Chapter 5 presented findings and implications from the research. The findings recapped the challenges faced by LLDCs, literature on dry ports and findings from analysis of data. The findings revealed that dry ports offer a superior opportunity for a landlocked country to improve its maritime access, to minimise transportation costs and to improve regional and international trade and competitiveness. Moreover, the shift of cargo from road to rail was seen as a very sustainable way to transport goods over long distances since road freight transport is affected by diminishing returns such as congestion and empty returns (Rodrigue & Notteboom, 2014, p. 21). Therefore, dry ports are an important subset of a modern integrated logistics system.

Notably, Southern African countries have embraced dry ports as seen in the City Deep dry port in South Africa, Isaka Dry Port in Tanzania, Ethiopia[54] and various dry port initiatives by the Walvis Bay Corridor Group (WBCG)[55] in the republic of Namibia. WBCG leased land for dry ports to landlocked countries such as Botswana, Zambia and Zimbabwe[56]. These dry port initiatives can be said to be a marketing tool aimed at increasing seaport hinterland access, thereby increasing port throughput. It was also found that many seaports in Southern Africa are marketing their services and competing for the position of African hub ports and regional African gateways[57]. Findings from questionnaire responses supported public-private partnerships sighting benefits of efficiency. Most respondents also confirmed the importance of dry ports.

Like many LLCs, Zimbabwe faces many challenges with maritime transport access. The good news is that dry ports can be used as an economic tool to improve the maritime access for LLCs. As a transit LLC, Zimbabwe can capitalise on the numerous advantages and benefits achieved from dry ports to and utilise its strategic position in SADC to achieve economic prosperity.

[54] Economic Commission for Africa,(ECA), Addis Ababa, Ethiopia, 24 November 2009 , ECA Press Release No. 70/2009: Experts and Officials Discuss "Dry Ports" in Ethiopia
[55] Dry ports: The untapped opportunity for African Freight Industry - Sandra Olivier, June 04, 2012.

[56] Zimbabwe's Walvis Bay Gift: Namibia courts the beautiful ones, Financial Gazette, 30 August 2012. The Zimbabwe Road Motor Services (RMS) was tasked to oversee the dry port project in Namibia.
[57] An example is the SADC African Gateway Port by NAMPORT.

The implementation of a border dry port at Beitbridge will not only reduce distance and long transit times normally faced, but it will significantly minimize shippers' transportation costs. Consequently, trade will significantly improve as more entrepreneurs can afford to trade at reduced transport costs. Improvements in trade will resultantly bear fruit through improved net exports[58] and hence export-led economic growth. Transit fees along may contribute a significant portion of national income. Moreover, maritime transport access will inspire economic recovery, regional and global trade participation and the overall national economic development and competitiveness of Zimbabwe.

The researcher's viewpoint is that LLCs can benefit from dry ports if dry ports can be effectively implemented and efficiently managed. This includes the efficiency of rail shuttles to the seaports and hinterland multimodal connections. On that note, there will be no landlocked country but an integrated logistics chain with its focal point at the seaport.

[58] Improved net exports will reduce trade imbalances and hence improve GDP.

5.4 Recommendations

The first recommendation for the government is to develop border dry ports at Beitbridge and Mutare[59]. Border dry ports must be developed inside the country but within the vicinity of the border. Beitbridge and Mutare are strategic border cities that have advantages of being located on important regional freight corridors. Moreover, they already provide customs and other value-added logistics services. In addition, these cities can easily develop into export processing zones (EPZ). While this research focused much on Beitbridge, a dry port at Mutare offers substantial benefits.

Another recommendation is to develop an efficient railway network, improve the rolling stock and upgrade existing roads since dry ports require efficient transport infrastructure. Therefore, the government should restructure and involve private sector participation in transport infrastructural projects, especially rail. Rail projects are capital intensive and require professional technical expertise. In typical PPP arrangements, the government assumes ownership of railway lines while the private sector is granted concession for operation and invests in wagons and locomotives.

In addition, Zimbabwe can learn lessons from established dry ports such as City Deep in South Africa and Modjo dry port in Ethiopia, which may be used as benchmarks. Studies may also involve universities and research institutions.

Dry ports require policy frameworks with neighbouring coastal States[60]. Therefore, Zimbabwe should seek the development of regional agreements on dry ports since Zimbabwe is a transit country. Moreover, SADC countries should establish a through freight rail policy to promote efficient rail transport. The objective is to expedite logistics in the region and reduce transport costs. Zimbabwe, by having a strategic inland position, can market itself [61]as a transit State and regional hub for transhipment of goods in Southern Africa. Moreover, dry ports, let alone seaport

[59] Development assistance may be achievable through organisations like COMESA, SADC, ADB, AU, UNCTAD, WTO and World Bank. A Mutare dry port represent an economic tool for Zimbabwe.
[60] Zimbabwe, Zambia, South Africa, Mozambique and Botswana
[61] A comprehensive dry port marketing plan should be developed to attract and convince shippers. In addition, a CRM system should be developed for long term customer relations.

concessions, cannot function properly short of intergovernmental agreements to ensure that there is political will and synchronization between seaport and dry port.

Looking forward, future research must address the time series analysis of freight volumes at border posts, which is often inaccessible. In addition, studies should cover economic impact of hedging instruments used by shippers and freight forwarders in LLCs to shield their vulnerability to supply chains risks so as to provide a panorama of the Zimbabwean shipper's dilemma.

Importantly, Africa is a continent that has untapped potential. Africa's favourable demographics are attracting new foreign investments and vertical integration in many sectors. While consumption patterns are standard in developed economies, they are still evolving in developing economies. Evidently, the changes in global supply chains and global shift in production locations are seen in growth of multinational business and rapid development of industrial parks and logistics zones around (border) cities in Africa. LLDCs should utilise this trend and develop infrastructure to sustain these developments. Dry ports are one such example.

To conclude, as industry and commerce continue to expand through globalisation, efficiency of transport and logistics become a very important subject for developing countries to address. Consequently, investing in dry ports is crucial for improving maritime transport access, trade-led economic development and overall competitiveness of landlocked countries, Zimbabwe included.

5.5 Research limitations

1. The researcher used convenience sampling technique due to the convenience and accessibility of participants at the time of research. Therefore, the sample size did not completely represent the actual population. For example, it did not cover views from shippers and freight forwarders. Moreover, there were time limitations.
2. Time series for cargo throughput at Beitbridge could not be established. Some annual data figures had to be approximated from surveys. Therefore, probabilistic sampling and statistical inference was limited in scope.
3. The researcher did not account for the cargo split between seaborne trade and regional trade between SADC countries to separate actual seaborne cargo. This was mainly due to time limitations and data inaccessibility.
4. The current rail policy framework among Southern African countries does not allow for locomotives to cross borders. Kunaka (2013) explained that changing locomotives at borders increases delays and affects the reliability of a railway system. This will negatively affect the objective of the dry ports. Absence of policy framework may result in resistance or sabotage from maritime states for fear of loss of market share to LLCs.
5. The research overlooked the current socio-economic challenges facing Zimbabwe. In addition, the quality of institutions was not considered. Quality of institutions influences dry port success or failure by creating parallel lines between objectives and actual results. Efficient administrations promote investment while inefficient institutions increase transaction costs, through negative factors such as excessive bureaucracy and corruption.

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Appendices

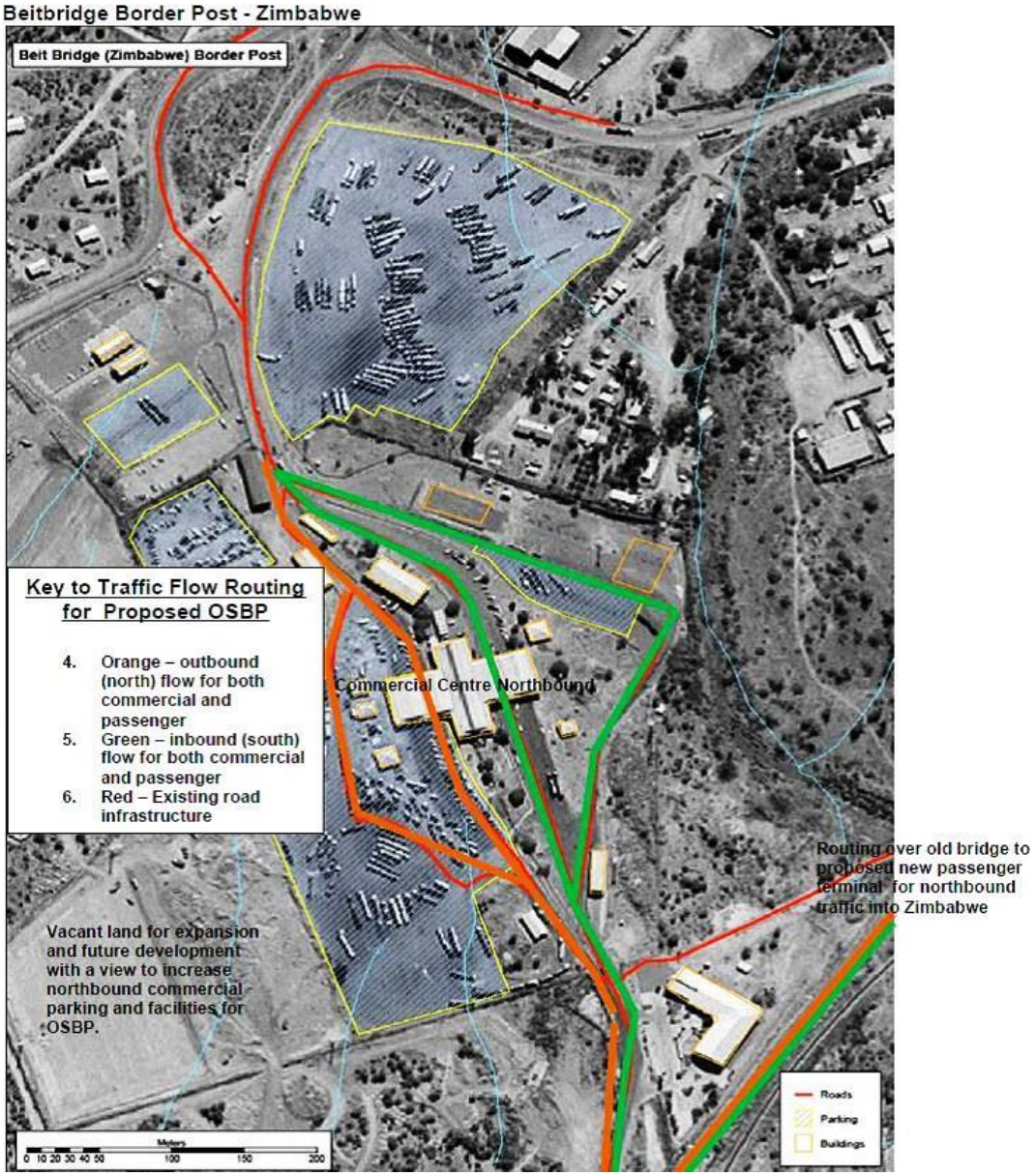
Appendix A. Overview of Beitbridge border post

Overview of Beitbridge border post showing the border control site, truck waiting area and other facilities illustrated by the key below. Source: (Fitzmaurice, 2009)

KEY

1. Main Terminal Building
2. Port Health
3. Insurance Office
4. Baggage Scanner
5. State Warehouse
6. Motor Vehicle Search Shed (Inward Bound)
7. Inward Post Clearance Shed
8. Passenger Clearance Hall
9. Mobile Scanner Shed
10. Scanner Workshop
11. Public Toilets
12. Generator Room
13. Outward Clearance Office
14. Motor Vehicle Search Shed (Outward Bound)
15. Duty Free Shop
16. VID Office & Weighbridge
17. Public Toilets
18. Police Assist
19. Insurance Office
20. Inward Bound Passenger, Taxi and Bus Parking
21. Inward Bound Park
22. Proposed New Commercial Truck Park (Inward Bound)
23. Vehicle Impound Yard
24. VID Vehicle Impound Yard
25. VID Weighbridge
26. VID Offices
27. Vehicle Parking Area (not in use)
28. Con-Dep (ZIMRA Inspection Yard)
29. Proposed New Commercial Centre

Appendix B. Situational analysis at Beitbridge border post with OSBP
Source: (Fitzmaurice, 2009)



Appendix C. Comparison of road and rail transport
Source: Compile by author.

Parameter	**Road**	**Rail**
Cost savings	High	Very high
Speed	Very high	Medium to high
Safety	High	Very High
Reliability	Very high	Very high
Flexibility	Very high	Low
Availability	Very high	Low
Environment benefits	Very low	Very High
Infrastructure costs	High	Very High
Maintenance costs	High	High
Economies of scale	High	Very High
Door to door deliver	Very high	Low
Suitability to carry different cargoes	High	Very High
Economical distance	Short	Very Long

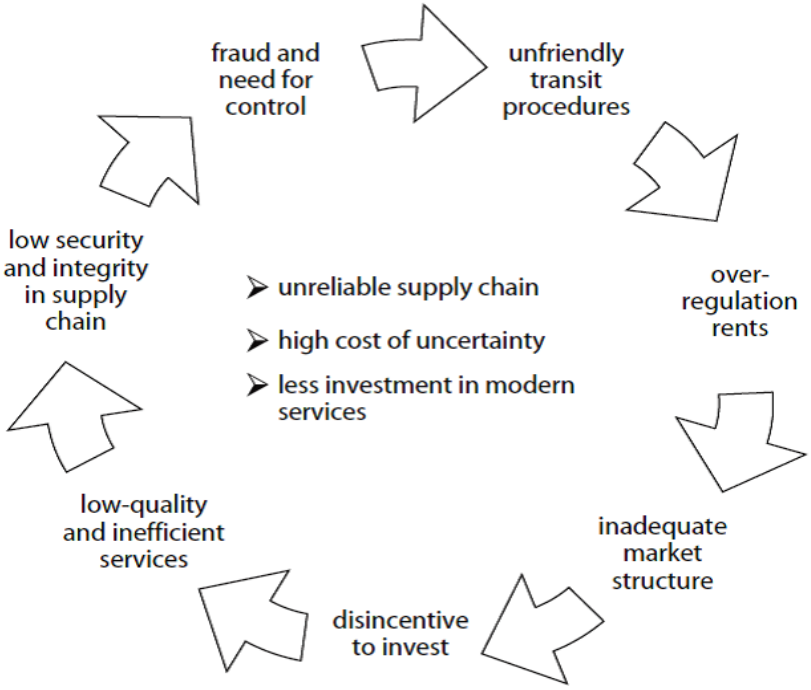
Appendix D. Competitiveness of South African ports in East and Southern Africa.
Source: (Drunen &Veldman, 2008, p. 35)

Port/Country	**Capacity (1000 TEU)**	**Share in %**
Nairobi	479	11%
Dar es Salaam	353	8%
Nacala	34	1%
Beira	54	1%
Maputo	63	1%
Mozambique total	151	3%
Richards Bay	3	0%
Durban	2,335	51%
East London	42	1%
Port Elisabeth	407	9%
Cape Town	765	17%
South Africa total	3,552	78%
Total	**4,535**	**100%**

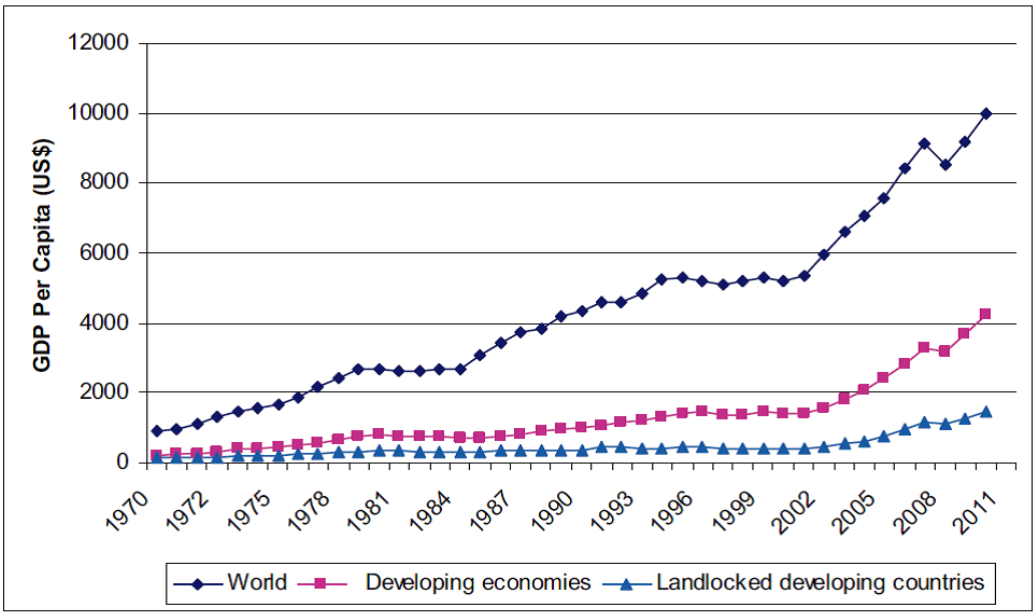
Appendix E. Analysis of road and rail distances in SADC
Source: (Jorgensen, 2013)

Route	Details	Rail Distance	Road Distance
Durban – Johannesburg	Rail via Ladysmith, road via Harrismith	743	578
Durban – Beit Bridge bdr.	Same as above	1 342	1 113
Durban – Harare	Via Beit Bridge(BB) and Rutenga	2 024	1 687
Durban – Blantyre	Road direct, Rail to Harare, then road	2 636	2 299
Durban – Lusaka	Rail via BB. & Bulawayo, road via Chirundu	2 684	2 394
Durban – Lubumbashi	Rail via BB, Bulawayo; road via Chirindu	3 276	2 933
Cape Town – Jo'burg	Rail via De Aar, Warrenton; road via Bloemfontein	1 535	1 402
Cape Town – Ramatlabama	Rail and road, via Three Sisters and Mafikeng	1 427	1 353
Cape Town – Harare	Rail via Gaberone, road via Bloem., Beit Br.	2 672	2 511
Cape Town – Blantyre	Same as above	3 184	3 123
Cape Town – Lusaka	Via Gaberone, Bulawayo; road via Chirundu	3 122	3 000
Cape Town – Lubumbashi	Same as above	3 714	3 539
Maputo – Johannesburg	Via Pretoria, slightly shorter via Germiston	635	601
Maputo – Harare	Rail via Rutenga, road via Inchope	1 228	* 1 500
Maputo – Blantyre	Rail via Rutenga, Harare; road via Inchope	1 840	1 721
Maputo – Lusaka	Rail via Rutenga, Bulawayo; road via Inchope	1 996	1 989
Maputo – Lubumbashi	Same a above	2 588	2 528
Beira – Harare	Via Mutare	593	565
Beira – Blantyre	Rail via Harare, road via Chimoio, Tete	1 205	786
Beira – Lusaka	Rail via Harare, Bulawayo, road via Chirundu	2 027	1 054
Beira – Lubumbashi	Same as above	2 652	1 593
Dar es Salaam – Lusaka	Via Tunduma, Kapiri Moshe	2 028	2 021
Dar es Salm. – Lubumbashi	Same as above	2 268	2 148
Walvis Bay – Johannesburg	Rail via De Aar, road via Upington, Vryburg	2 256	2 101
Walvis Bay – Jo'burg via Trans Kalahari	Rail via De Aar, road via Mamano and Lobatse	2 356	1 723
Walvis Bay – Lusaka	As above, but via Botswana to Bulawayo	4 153	3 619

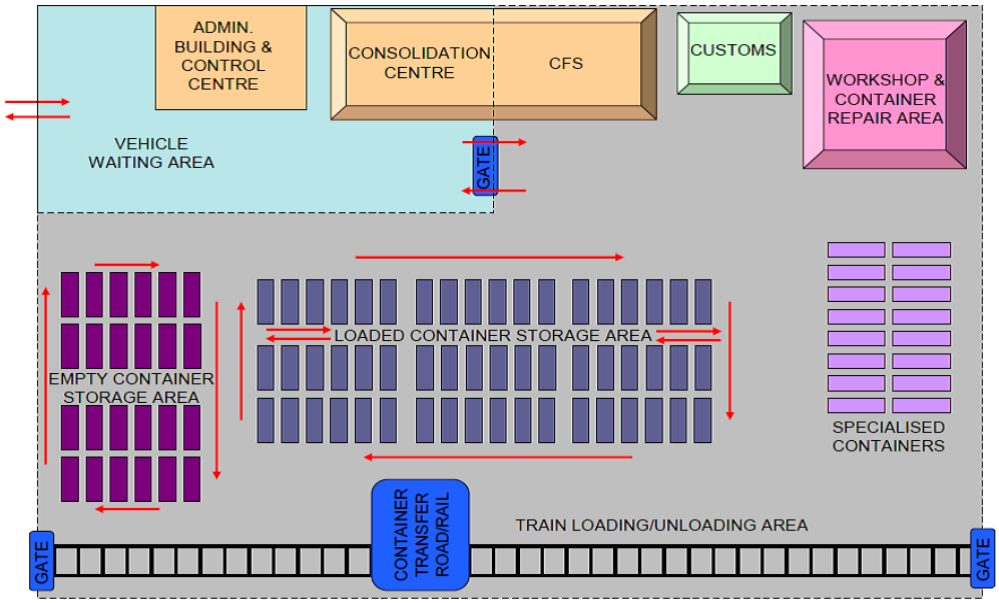
Appendix F. The vulnerability of the supply chains to rent-seeking activities
Source: Arvis et al. (2010)



Appendix G. Comparison of LLDCs GDP per capita against the world, developing and developed economies (1970 – 2011).
Source UNCTAD (2013)



Appendix H. Potential dry port configuration
Source: Dryport Project (2012).



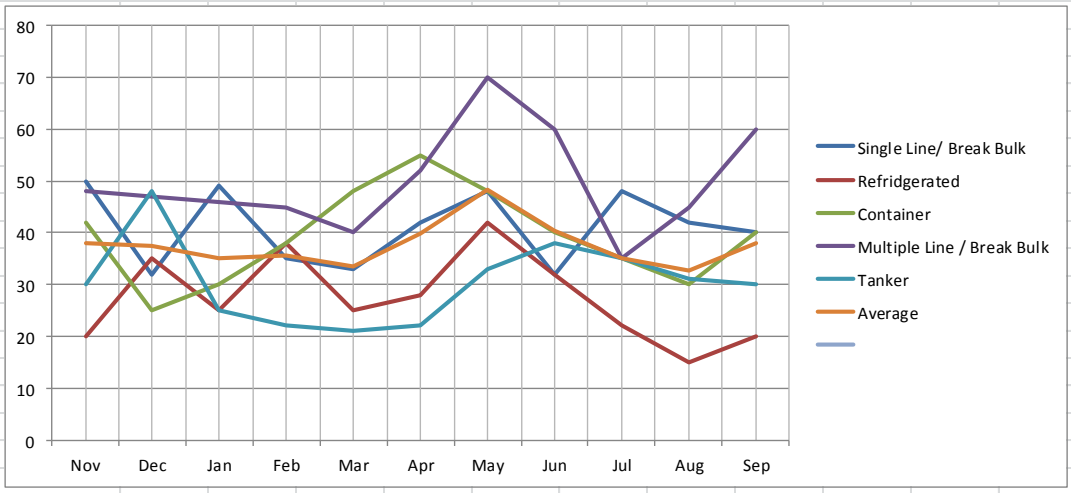
Appendix I: SWOT Analysis for Mutare dry port.

Source: Author.

Forbes Border Post lies between Zimbabwe and Mozambique, a few minutes' drive from Mutare. It is the gateway to the Beira corridor and link to the port of Beira. Mutare is a favourable option for dry port because of the short distance to the sea port of Beira (only 290 kilometres). The current Mutare dry port is a joint venture between Cornelder de Moçambique and GMS Freight Company located in Mutare .			
Strength	**Weaknesses**	**Opportunities**	**Threats**
Short distance to seaport of Beira (290 Km)	Depth challenges at seaport restrict bigger ships.	Anticipated trade-led economic growth.	Stiff competition from South African seaports.
Strategic location on Beira corridor.	Seaport has poor road and rail connectivity.	Abundant natural resources in the region.	Sedimentation of seaport channel.
Green logistics corridor, strong in agriculture and fertiliser shipments.	Inefficient container logistics and cargo handling.	Projected high traffic with trade growth.	Trade imbalances affect logistics performances
Established road infrastructure with rail links to both seaports and inland destinations.	Poor government policy, upkeep of road and rail infrastructure.	Public private cooperation in upgrading of roads and railways.	High freight rates in despite short distances
Facilities such as customs clearing, and warehousing, container yards.	Poor financing, maintenance of facilities.	Land use opportunities e.g. Logistics parks.	Absence of harmonised regional dry port policy.
Adequate land availability, room for expansion, growth of logistics centres.	High traffic congestion on the corridors.	New source of employment.	High costs of inland transportation.

Appendix J. Chirundu border transit times
Source: (Curtis, 2009)

	Month : 2006 / 2007										
	Nov	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Single Line/ Break Bulk	50	32	49	35	33	42	48	32	48	42	40
Refridgerated	20	35	25	38	25	28	42	32	22	15	20
Container	42	25	30	38	48	55	48	40	35	30	40
Multiple Line / Break Bulk	48	47	46	45	40	52	70	60	35	45	60
Tanker	30	48	25	22	21	22	33	38	35	31	30
Average	38	37.4	35	35.6	33.4	39.8	48.2	40.4	35	32.6	38



Chirundu Border post crossing times. Source: (Curtis, 2009)

Appendix K. Optimal dry port location for Zimbabwe using centre of gravity. Source: Author's own calculations.

Optimal centre of gravity for new dry port for Zimbabwe					
D = $\sqrt{(X_1 - X_2)^2 + (Y_1 - Y_2)^2}$		Heuristic Solution:	x = $\frac{\Sigma X_i L_i}{\Sigma L_i}$	y = $\frac{\Sigma Y_i L_i}{\Sigma L_i}$	
	Cities Coordinates		**Load**	**Distance from**	
	X	Y	Li	**Dry port**	
City	**South Latitude**	**East Longitude**	**Population**		
Harare	17.86	31.03	1,485,231.00	0.000294877	
Bulawayo	20.17	28.58	653,337.00	3.364241327	
Chitungwiza	18.00	31.05	356,840.00	0.137311537	
Mutare	18.97	32.63	187,621.00	1.945985055	
Gweru	19.46	29.80	157,865.00	2.014448668	
Kadoma	18.34	29.90	92,469.00	1.225873793	
Masvingo	20.07	30.83	87,886.00	2.218971397	
Chinhoyi	17.35	30.20	77,927.00	0.976165444	
Optimal dry port location	**17.86**	**31.03**			
Heuristic Solution	**18.58**	**30.49**			
		Total load distance	3,314,979.64		
Conclusion: The optimal centre of gravity for a dry port using solver is Harare.					
The possible dry port location using the centre of gravity heuristic is north of Chivhu; see map.					
The map below shows the mapping of the two geographic coordinates					
The model is based on city loads (population) assuming all people consume the same.					

Appendix L. Dissertation Questionnaire
Source: Compiled by author.

Dissertation Questionnaire

As part of my postgraduate research towards the Masters of Science degree in Maritime Affairs, Shipping Management and logistics specialization at World Maritime University, I kindly request your participation in completing the attached voluntary questionnaire. The information obtained shall be used in my dissertation entitled, “Unlocking the landlocked - Appraising the economic viability of dry ports for Zimbabwe” The objective of my research is to ascertain whether or not dry ports can be used as an economic tool for improving maritime transport access for landlocked countries.

A dry port is an inland inter-modal terminal that is directly linked to the seaport(s) by high capacity transport means, such as railway or inland waterways, where shippers can leave or pick up their standardised units as if directly left at seaport (Leveque & Roso, 2002). Close-range dry ports are located less than 100 kilometres from the seaport while mid-range dry ports are located between 100 and 500 kilometres from the sea port. Those located more than 500 kilometres from the seaport are termed distant dry ports. Border dry ports are located in border areas or cities. Since their introduction, dry ports have emerged as an integral part of contemporary integrated logistics systems, offering many benefits. Consequently, I would like to ascertain your opinion on this subject. Your views will be very important to my research.

This research is being undertaken at the World Maritime University in Malmö, Sweden and is not funded by any external agency. Participation in this questionnaire is voluntary and all information obtained during the research shall be used only for the purposes of research and it shall be kept in the strictest confidence and guaranteed anonymity.

Where the participants are students, the participation in this questionnaire is not obligatory, nor will it in any way contribute towards or impact on the student’s final assessment.

I will be grateful if you take your time to complete the questionnaire attached herewith, where it is relevant in your profession:

Please specify your profession!

- ☐ Shipping Managment
- ☐ Ports Management
- ☐ Logistics and supply management
- ☐ Legal Occupation
- ☐ Other

Please specify Other.

Are you familiar with the dry port concept?

- [ ] Yes
- [ ] No

Does your sea port have dry ports linked to it?

- [ ] Yes
- [ ] No

If the answer above is yes, please specify type of dry port

Distant (over 500 Km); Mid Range (100- 500); Close Range (less than 100 Km) from the sea port.

- [ ] Distant
- [ ] Mid Range
- [ ] Close Range
- [ ] Border Dry port
- [ ] City Dry port

If your answer was "No", does your port have plans to develop dry ports?

- [ ] Yes.
- [ ] No.

In your opinion, do you think dry port development is important for the seaport?

Please indicate 1-5 in terms of importance

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly agree

In your opinion, please rank the importance of dry port to shippers.

	1	2	3	4	5	
Not Important	○	○	○	○	○	Very Important

Please rate the benefits from dry port for road (trucking) businesses

	1	2	3	4	5	
Few benefits	○	○	○	○	○	Many benefits

What is your opinion on importance of dry ports to society?

	1	2	3	4	5	
No contribution to society	○	○	○	○	○	High contribution to society

What is your view on impact of dry port in saving the environment?

	1	2	3	4	5	
Negative effects	○	○	○	○	○	Positive effects

What do you believe is the effect of long distance on trade and transport costs?

	1	2	3	4	5	
Negative effects	○	○	○	○	○	Positive effects

Do you believe dry ports will reduce trade and transportation costs for landlocked countries?

	1	2	3	4	5	
Strongly disagree	○	○	○	○	○	Strongly Agree

What type of ownership exists for your dry port?

- ☐ Public Ownership.
- ☐ Private Ownership.
- ☐ Public-Private Partnership.

What do you think of the award of concessions to shipping lines and global terminal operators to operate terminals?

	1	2	3	4	5	
Very negative	○	○	○	○	○	Very Positive

What do you think of the modal shift of cargo from road to rail transport

	1	2	3	4	5	
Unimportant	○	○	○	○	○	Very Important

Currently, dry ports (border and distant dry ports) are being developed in landlocked countries and connected directly to seaports by rail. Do you think dry ports can improve maritime access for landlocked countries?

	1	2	3	4	5	
Highly Disagree	○	○	○	○	○	Highly Agree

What in your opinion are the factors that limit dry port implementation for a landlocked country?

- ☐ Environment concerns
- ☐ Land use factors
- ☐ Policy inconsistencies
- ☐ Financial constraints
- ☐ Infrastructural challenges
- ☐ All of the above

Section B: Analysis of options to improve maritime access for LLCs.

Please take a moment to contrast the three potential options that a landlocked country may take in order to improve its maritime access. Kindly mark with an X to the score for each option. A weight of 1 means least significance while a weight of 5 shows highest significance.

Aspect	Option 1: Develop border dry port					Option 2: Terminal concession					Option 3: Maintain current system				
COSTS	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Road infrastructure costs															
Rail infrastructure costs															
Facilities (sheds, offices, customs area, rail siding, CFS, etc.)															
Cargo handling equipment (gantry cranes, forklifts, etc.)															
Land acquisition costs															
Design costs															
Environment impact assessments															
BENEFITS	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
Benefits to seaport – like reducing congestion, noise etc.															
Benefits to shippers like reducing distances and shipping costs etc.															
Benefits to trucking businesses.															
Benefits to government – like improving trade, customs etc.															
Improving trade and transport logistics.															
Benefits to environment - reduce carbon footprint, noise etc.															
Benefits to rail operators – improving rail capacity utilisation															
Benefits to society- Job creation for locals etc.															
Strengthening Corridors															
Creation of jobs to society															