

UNIVERSITY OF KWAZULU NATAL

**Project selection modelling for infrastructure investment
programmes: the case of the Ports Authority, South Africa**

By

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DECLARATION

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DEDICATION

I dedicate this thesis to my mum. A strong, determined force that pulled my sisters and I out of poverty, the death of my dad and life's challenges. She showed us the light with her gentle, loving guidance. She didn't allow us to dwell on misfortune. She taught us to see positivity in every adversity, to treat people with kindness and to live with integrity. She taught us that everything is possible.

Thanks mum!

GLOSSARY OF TERMS AND ABBREVIATIONS

4.0 strategy	Four Point O Growth Strategy
BMM	Benefit Measurement Method
CAPEX	Capital Expenditure
CAPIC	Capital Investment Committee
CIDB	Construction Industry Development Board
DPE	Department of Public Enterprises
ETC	Estimated Total Cost
EVM	Earned Value Management
FEL	Front End Loading
GC	Group Capital
GCE	Group Chief Executive
GCIA	Group Capital Integration and Assurance
GDP	Gross Domestic Product
GLT	Group Leadership Team
GR	Gate Review
ICPAF	Integrated Capital Project/ Program Assurance Framework
IRR	Internal Rate of Return
MDS	Market demand strategy
MTM	Marine Transport and Manufacturing
NAC	National Acquisition Council
NDP	National Development Plan
NEC3	New Engineering Contract [Version 3]
NIP	National Infrastructure Plan
NPA	National Ports Authority
NPV	Net Present Value
OPEX	Operational Expenditure
PDFP	Port Development Framework Plan
PFMA	Public Finance Management Act (1999)
PLP	Project Lifecycle Process
PMBOK	A Guide to the Project Management Body of Body of Knowledge, 5th Edition
PM- CoE	Project Management Centre of Excellence
PMO	Program Management Office
PRSA	Ports Regulator South Africa

S&P	Standard and Poor
SADC	South African Development Community
SAPO	South African Ports Operations
SARB	South African Reserve Bank
SOE	State Owned Entity (transport organization)
TEU	Twenty-Foot Equivalent Unit
TOA	Terminal Operator Agreement

ABSTRACT

The successful delivery of any infrastructure portfolio relies on prioritizing projects aligned to organizational objectives. The Ports Authority of South Africa, in pursuit to expand its gigantic infrastructural portfolio, requires appropriate project selection techniques that would attract capital investment. The aim of the study was therefore to explore the project selection techniques in planning for infrastructure development at the Ports Authority with the ultimate goal of setting up a project selection and prioritization model that encompasses the key selection criteria aligned to the Department of Public Enterprises, National Development Framework Plan and Port Strategy. In the past, poor project selection techniques lead to poor delivery, which rendered capital investments fruitless and wasteful thus eroding the confidence in the port's performance and resulting in claw backs and tariff adjustments. The corporate plan was being used as a project prioritization tool and this was not aligned to international good practice. The study applied the mixed method Sequential Exploratory Design on a study population of 108 employees to identify the project selection criteria and develop the project selection and prioritization model as an outcome of the qualitative analysis. Thereafter the study used quantitative analysis to test the model in improving investment decisions at the Ports Authority. The qualitative data was collected from the six (6) respondents purposively selected from twenty (20) senior managers. The quantitative data was collected from 58 respondents randomly selected from the study population of 108 employees. The mixed method analysis triangulated findings from the qualitative and quantitative analysis in proving the hypothesis that project selection criteria did influence project selection and prioritization for improved investment decisions at the Ports Authority in South Africa. The study recommended improvements to capital approval processes, remedies for project performance monitoring and training of employees. Response plans were proposed to guide the organisation on when and how to respond to triggers. The study demonstrated how portfolio theory could be enhanced and adapted for state-owned enterprises to align with the strategic objectives of the organization as opposed to having purely financial focus; thereby making infrastructure investment decisions more lucrative to all stakeholders.

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CHAPTER 1

OVERVIEW OF THE STUDY

1.1 Introduction

This study focuses on the project selection techniques used in planning for infrastructure development at the Ports Authority as an economic stimulus to support faster economic growth in South Africa. The objective was to set up a project selection and prioritization model that encompassed the key selection criteria aligned to the Department of Public Enterprises, National Development Framework Plan and Port Strategy. Chapter one presents the background of the study, the problem statement, the research aim and objectives, the scope of the study, definition of key terms used in the study and the organization of the chapters that constitute this study.

1.2 Background to the study

The subject of this research originated owing to the strained economic conditions, the lower than projected growth, and a drop in commodity prices in South Africa. State-owned Entities (SOEs) were under severe pressure to fund capital programmes over the next 7 years as highlighted by the Minister of Finance (Gordhan, 2017) where emphasis was on those responsible for deciding how money was spent had to do so with “scrupulous rigour and care” because the infrastructure investment and financial development of public entities played a pivotal role in the fiscal framework of South Africa. Of foremost concern within SOEs was the lack of progress in implementation of economic plans to realize benefits. At the 2018 state of the nation address, the South African President, presented the 10-point plan for the new administration and emphasized restoration of SOEs as drivers to economic growth and social development. In November 2017 South Africa was downgraded to below investment grade (junk status) by both Standard and Poor (S&P) and Fitch ratings agencies (Transnet, 2018). The implications of the economy falling into recession would hinder the implementation of the National Development Plan (NDP) objectives (Moneyweb, 2017). The cost of funding was expected to increase for State-owned Entities (SOEs) thereby making it increasingly difficult to secure infrastructure funding (Calatayud, Palacin, Mangan, Jackson, Ruiz-Rua, 2016:1-14). Many private investors were not mandated to invest in countries or companies that were below investment grade and hence SOEs had been asked to pay back as much as R 5.6bn in loans from private investors. The Ports Authority was one such SOE in South Africa whose strategic efforts, in the short term, were focused on managing its regulatory obligations, delivering on its planned infrastructure programme, improving operational performance, and enhancing customer relations.

As part of the total value proposition to facilitate market segment competitiveness (Transnet, 2019) (Department of Public Enterprises, 2019), According to Ndlozi (2016: 1-87), South African ports had suboptimal capacity, aged and unreliable infrastructure and diminishing skills. South Africa was therefore tasked to look at ways to cut expenditure worth about R25 billion and to identify “revenue-enhancing measures”, which should generate approximately R15 billion (Moneyweb, 2017). Ndlozi, (2016: 1-87) also stated that South African ports were challenged by its exorbitant port tariffs and increasing foreign debt used to fund port infrastructure.

According to the Transnet Online Integrated Report (2019), the Ports Authority ensured the competitiveness of the South African ports systems and supported economic growth as mandated by its role as a regulated state owned entity. To this end, the Ports Authority was legally required to submit an annual proposal to the Ports Regulator South Africa before making any major adjustments to the port tariff structure and methodology (Meyiwa &

Chasomeris, 2016). The final tariff was approved based on an informed decision made in accordance to the National Commercial Ports Policy (PRSA, 2019), the National Ports Act (2005) and the regulatory directives. The rejection of tariffs was also based on similarly informed decision owing to poor historic performance by the Ports Authority in delivering on stakeholder commitments (Fakir, 2018: 1-58).

This study was required to review the key challenges with investment in infrastructure programmes at the Ports Authority in South Africa. The operating model of the Ports Authority did not require foreign investment to fund infrastructure investment programmes. The tariffs received by the ports should be sufficient to create capacity ahead of demand, sustain existing infrastructure and achieve regulatory compliance without incurring debt (Fakir, 2018: 1-58). In the past, poor project delivery rendered capital investments as irregular expenditure in terms of the Public Finance Management Act 1 of 1999, and eroded confidence in the port's performance resulting in claw backs and tariff adjustments (Havenga, Simpson and Goedhals-Gerber, 2017: 1-13). The net effect of the substantial tariff reductions meant that the Ports Authority had to rely on foreign investment to finance infrastructure programmes. The recent downgrade of South Africa's rating to junk status resulted in an increasing cost of capital to service debt from foreign investments. The cost of capital had to be kept to a minimum to attract private investors (Mchizwa, 2014:1-58).

1.2.1 Global context and trends

Through research, Wheeler (2013: 1-89) reviewed various project and portfolio selection techniques globally and recommended a project selection approach for organisational fit particularly with respect to selection of investment programmes for government investment projects in China. Wheeler's recommendation was that the standard for portfolio management included stronger links to the strategic objectives of government. While most multi-criteria decision methods (MCDM) were employed successfully in private industry as evidenced by Wheeler's article, the research recommended the Analytical Hierarchical Process (AHP) for project selection in SOEs. AHP appeared to be more integrative and better able to accommodate strategic objectives of government, and objective enough to guide the inefficiencies in decision-making while still being adaptable to stringent governance processes and procedural delays particularly with financial management and procurement. Benaija and Kjiri (2015: 1-11) emphasized that unlike in private enterprises that were primarily profit driven, the key to success in project selection and portfolio management in state-owned entities was to use an interactive approach, through the intervention of decision makers, to define the selection criteria, maximize the organization's value; balance the portfolio (in order to minimize the risk) and finally to adjust the portfolio to align with the organization's strategy (strategic alignment). Hlotywa and Ndaguba (2017:1-12) had also proven that port infrastructure investment stimulated economic development. Their study recommended that risk management in the maritime sector must include for thorough interrogation and performance management of the investment in order to have the intended impact on port efficiency, effectiveness and stakeholder management. Nyamita and Wekesa (2015:1-14) successfully implemented a project evaluation framework in Kenya, an African country almost the size of South Africa, and showed increased management of enterprise risk through the evaluation framework. As recommended by these authors, the project selection criteria had to incorporate enterprise risk management be demonstrated through safety initiatives. Projects with improved safety levels were more likely to be prioritized since they reduced/ eradicated fatalities and injuries to staff and other port users. Regulatory and environmental compliance was also included in the selection criteria as it contributed to sustainable green ports.

According to Calatayud et al (2016:1-14), the projects should also be selected if they scored well on enterprise risk which meant that the business risk impact of not doing the project was high.

Odongo and Ojah (2016:1-21) had stated that while investors were very aware of the funding gap for infrastructure development in sub-Saharan Africa, weak governance within public infrastructure sectors had raised concerns over investment viability. Oniszczyk-Jastrzabek, Pawłowska and Czermański (2018:1-11) stated that the term green ports had been recently introduced and referred to ports that made investment decisions with increasing focus on decarbonisation of the marine sector by Ports Authorities. While infrastructure investment and capacity building were constrained by budgets, there must be an urgent drive to embrace the green port systems with respect to port policy and environmental regulations when investments were being considered. Bergqvist and Monios (2019:1-17) advocated that all infrastructure investments be mindful of climate change mitigations even if this impacted the financial viability of the investment. The authors also recommended that the project selection criteria include capacity creation to maintain adequate, reliable, sustainable port infrastructure. Capacity creation could be achieved through increasing capacity in fleet and infrastructure, leveraging market growth opportunities and promoting optimized land use.

The academic review of infrastructure investment programmes in the global context did not elaborate on how the Ports Authority should position itself to stimulate economic growth in South Africa or on the critical success factors that should be prioritised to overcome the challenges in securing funding for infrastructure development. While the research cited above was congruent with the general theme that the Ports Authority would lose market share and investor funding if it continued with current trends of poor performance, non-delivery of infrastructure and exorbitant port tariffs, it was materially lacking in proposing a port doctrine or on recommending solutions to close the gaps and improve the Ports Authority's competitive positioning globally. Further, while the authors did state the challenges experienced by the Ports Authority in developing competitive intelligence to secure investor confidence, there was no frame of reference in terms of how these challenges had been successfully overcome in similar state-owned entities in the marine sector. There were also limited best practice benchmarks to alleviate issues impacting the Ports Authority, in terms of competitiveness, investor confidence, growth, transitioning for diversification and preference, in the African and global context of world class logistic service providers in the maritime sector. The literature seemed to suggest that successful project delivery depended on having the right people skills and levels of experience, however there was no emphasis on choosing the right projects to begin with. The research above lacked in identifying the critical success factors for Transnet with reference to the Market Demand Strategy, Port Development framework plans or the Transnet 4.0 strategic thrust. Several scholars agreed that infrastructure investment in developing countries was pivotal to economic growth (Ikome, Nguendi and Tama, 2016:255-277) (Acciaro, 2013: 207) (Ndlozi, 2016:1-87). The literature review did not present with findings of a recommended framework for selecting projects in state-owned entities within South Africa.

1.2.2 National context and trends

1.2.2.1 South Africa's Objectives

South African Minister of Finance (2019) forecasted that the economic growth of South Africa would be slashed by half, from 1.5% to a paltry 0.7%. The annual budget speech raised concern over SOEs, in particular Eskom, responsible for producing 95% of the country's electricity, mired in debt and inefficiencies. The 2018/19 load-

shedding fiasco had left the economy reeling and the 96-year-old giant parastatal was considered a threat to national security, because if it failed, so did the South African economy. In the State of the Nation Address (2019) the South African president identified the following key priorities for South Africa:

1. Accelerate economic growth and create jobs
2. Improve education and skills development
3. Improve the conditions of life for all South Africans
4. Fight corruption and state capture
5. Strengthen the capacity and capability of the state to address the needs of the people

In responding to the president's key priorities, the Minister of Finance announced that South Africa was prioritizing resources towards the president's infrastructure fund. In so doing, the country planned to accelerate R526 billion worth of on-budget projects through private sector participation and development finance institutions. In addition, the government would increase its stake by committing R100 billion to state owned infrastructure development over the next decade. If the South African economy had a junk status, the country's ability to repay loans was seen as risky, hence the cost of borrowing would increase resulting in higher cost of debt to the National Treasury (Meyiwa and Chasomeris, 2016: 1-20) (Fakir, 2018: 1-58). Every additional rand that the National Treasury spent on interest payments was a rand that could not be used to improve basic social services for the struggling population of South Africa. Hence the increased government investment incentive to motivate successful infrastructure project delivery as well as the looming junk status were motivators for successful infrastructure programme delivery in South Africa.

1.2.2.2 Department of Public Enterprises objectives

The Department of Public Enterprises (DPE, 2019) was one of the shareholder representatives within the South African government with oversight responsibility for a number of State-owned Entities (SOEs) including Transnet as illustrated in Figure 1.1. The Department of Public Enterprises (DPE) aimed to drive productivity, investment and transformation in the department's portfolio of SOEs. The DPE's primary objectives were focused on customers and suppliers by driving industrialisation, promoting growth and prioritizing job creation and skills development.

SOEs have a crucial role to play in advancing economic growth in the development of key infrastructure and manufacturing capacity for South Africa. Transnet is a strategic instrument in the government's freight and logistics chain and is a public company wholly-owned by government. The DPE aims to ensure that SOEs are aligned with the government's medium term strategic framework. Infrastructure investments are a core part of the accelerated growth strategy. It is therefore of national strategic importance that significant and sustained opportunities for investment are created through Transnet's investment programmes in capital infrastructure development.

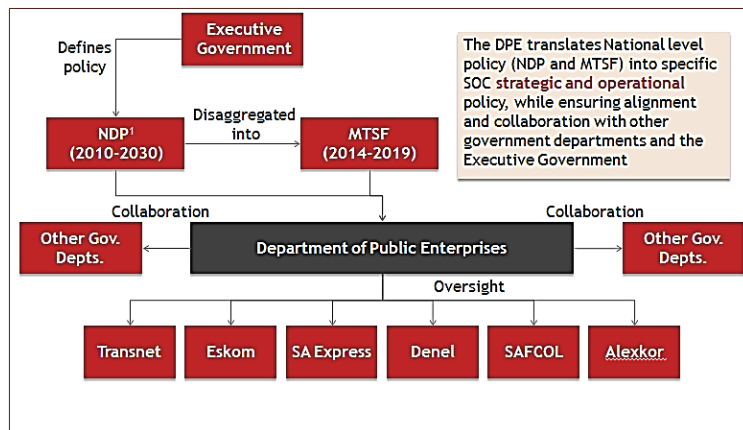


Figure 1.1: Conceptual model, demonstrating the translation of the NDP [Source: www.dpe.gov.za]

1.2.2.3 Department of Transport Objectives

According to the Official Guide to South Africa 2017/18, the Department of Transport (DoT) is responsible for all infrastructure and operations of rail, pipelines, roads, airports, harbours, and the intermodal operations of public transport and freight. Economic growth is achieved by connecting people and goods to markets through an efficient and competitive transport system. A key objective of the National Development Plan (DPE, 2019) was the development and maintenance of an efficient and competitive transport system within South Africa. The department's strategic goals ensured an efficient and integrated infrastructure network that catalysed social and economic development; ensured a safe and secure transport sector; improved rural access, infrastructure and mobility; improved public transport systems, and increased the contribution of the transport sector to job creation. Hlotywa and Ndaguba (2017:1-12) examined the relationship between road transport investment (ROTI) and economic development (ED) in South Africa. The article used "the Harrod–Domar (HD) model of economic growth and development theory, endogenous growth theory and Solow–Swan neoclassical growth model" to show that investment in transport infrastructure directly impacted economic development, job creation and quality of life within the geographical area. Their article also purported that investment in road infrastructure in each instance "raises productivity of workers, reduces cost of transportation, reduces turnover time and provides safety within a country" Hlotywa and Ndaguba (2017:2). These soft benefits exceeded profit margins and financial model expectations of investment projects. The strength of the article reaffirmed the direct proportionate relationship between investment in a country's state owned infrastructure and the growth in economy. The article also recommended that stimulating savings through prioritized investments improved both the hard and soft benefits of the capital investment.

1.2.2.4 State-owned Entities

State-owned entities are described as independent bodies that may be partially or wholly under the custodianship of government, developed to perform specific functions for the National Development Plan of South Africa (NDP, 2013). In keeping with international trends, South Africa introduced state owned entities in some sectors to promote more effective and efficient service delivery. As illustrated in figure 1.2, SOEs directly impact the development of good energy sources, ample water supply and reliable transport connections for the growth of cities and scattered settlements in the NDP of South Africa. The NDP had raised concerns over the poor

performance of SOEs where investment levels were insufficient and maintenance programmes were lagging behind (NDP, 2013).

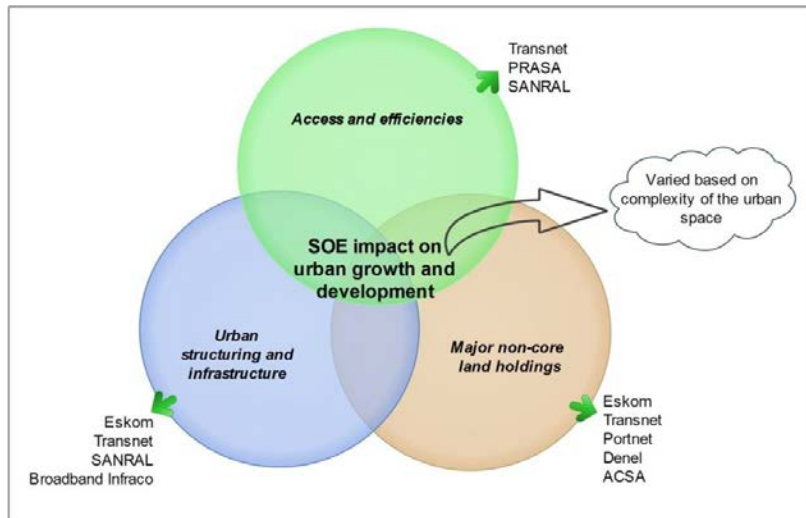


Figure 1.2: Categories of SOEs which influence urban growth and development as per NDP (2013)

The Department of Public Enterprises (DPE) has custodian oversight over eight state owned entities in South Africa. SOEs are the key mobilizers for accelerating economic growth and development for any country and in South Africa, the SOEs are responsible to reduce the relative cost of energy and transport; ensure higher levels of employment through job creation and local supplier development, support initiatives and reduce inequality by encouraging meaningful black participation in the ownership, control and management of the fiscal environment. Despite common perception, SOEs are not funded by the South African government. The cost of capital has to be kept at a minimum to attract private investors (Mchizwa, 2014). Hence business opportunity framing in SOEs was of paramount importance in getting the competitive edge to attract foreign investment. According to Fraser and Notteboom (2016), port objectives in South Africa were not reflective of the tariffs charged since South Africa did not have a clearly defined port doctrine required by the National Ports Act (Act no. 12 of 2005). Furthermore, SOEs were at risk of losing market share since other countries on the African continent had latched onto the concept of capacity creation ahead of demand and had developed plans for new capacity within the freight logistics industry. Table 1.1 illustrates the projected public sector borrowing requirements according to the National Treasury, South Africa. SOEs compete for funding against other South African parastatals as well as developing nations in the global context. SOEs need to be competitive in their growth, investment and infrastructure delivery strategies in order to attract foreign investment.

Ndlozi (2016: 1-87)) stated that the majority of the infrastructure development projects, in parastatals was driven by an urgent need and pressure to deliver returns on investment and not by opportunities for growth and expansion. Generally, beneficiaries were cautious to invest in assets or infrastructure with poor return on investment. The implication was that the lending rate increased to attract investors. An increased lending rate would affect the affordability ratios and return on investment of capital projects. Hence business opportunity framing as well as project selection and prioritization became pivotal to business success.

Table 1.1: Public Sector Borrowing Requirement [Source: National Treasury]

Table 8.2 Public-sector borrowing requirement¹

	2013/14	2014/15	2015/16	2016/17		2017/18	2018/19	2019/20
	Outcome			Budget 2016	Budget 2017	Medium-term estimates		
R billion/percentage of GDP								
Main budget	160.4	166.4	168.4	156.3	170.5	166.8	171.2	180.7
Social security funds	-13.5	-15.8	-18.9	-20.6	-19.8	-21.4	-23.2	-24.4
Provinces	-4.3	-6.2	-0.6	1.0	0.6	-0.6	-0.8	-1.0
Public entities	-6.6	-9.5	-7.1	1.0	-2.6	4.1	-5.7	-9.9
RDP Fund ²	-0.6	-0.4	0.5	1.2	-0.8	0.2	0.4	0.4
Consolidated government	135.4	134.6	142.2	138.9	147.9	149.0	141.9	145.8
	3.7%	3.5%	3.5%	3.2%	3.4%	3.1%	2.8%	2.6%
Local authorities	7.8	9.4	11.0	9.8	11.4	11.0	11.3	11.5
	0.2%	0.2%	0.3%	0.2%	0.3%	0.2%	0.2%	0.2%
State-owned companies³	57.1	79.6	121.9	72.9	95.0	91.8	84.0	85.3
	1.6%	2.1%	3.0%	1.7%	2.2%	1.9%	1.6%	1.5%
Borrowing requirement	200.3	223.6	275.1	221.6	254.4	251.7	237.1	242.6
	5.5%	5.8%	6.7%	5.1%	5.8%	5.3%	4.6%	4.4%

1. A negative number indicates a surplus and a positive number a deficit

2. Reconstruction and Development Programme Fund

3. SANRAL and Trans-Caledon Tunnel Authority are included as public entities under consolidated government borrowing

Source: National Treasury

1.2.2.5 Lack of Foreign Direct Investment

The downgrade of South Africa's economic rating to 'junk status' implied an increasing cost of capital to service debt from foreign investments. This meant that South Africa, as an emerging market, operated at a budget deficit. The country spent more than it earned and borrowed money to fund the deficit (Nienaber, 2014: 1-34). A study by Havenga, Simpson and Goedhals-Gerber (2016) emphasized the role of the port in the international trade logistics system and the fragmented cost model employed in calculating the competitive position of South African ports in the international trade logistics framework. Generally, investors were cautious to invest in assets or infrastructure with poor return on investment so interest rates would increase to attract investors. An increased interest rate would affect the affordability ratios and return on investment of capital projects. The cost of capital had to be kept to a minimum to attract private investors (Mchizwa, 2014). The Department of Public Enterprises' (DPE, 2019) has custodian oversight over the eight SOE's within South Africa and seeks to regulate and monitor the relative cost of energy, transport and telecommunications driven by the impact of SOEs on the country's economy. The publication of the DPE Strategic Plan and Annual Performance Plan for 2014/15-2018/19 (DPE, 2019) was aligned with the South African government's strategic framework and informed by the National Development Plan (NDP) of each port within South Africa. The NDP strives to accelerate economic growth by expanding employment and reducing poverty in South Africa. There was a drive to stimulate the economy through SOE's infrastructure development programme as this formed the bedrock of the country's economic potential for growth and diversification. Table 1.2 illustrates the SWOT analysis tabled by the DPE Strategic Plan (2019). The cells highlighted in green illustrate those strengths, weaknesses, opportunities and threats immediately contributing to SOE relevant risks the DPE would have to manage in order to ensure delivery of its strategic objectives. Table 1.3 lists the risks identified by the DPE in ensuring compliance with the Public Finance Management Act (PFMA, act 1 of 1999) and National Treasury regulations. The DPE was poised to manage any uncertainty regarding delivery of its strategic objectives. The cells highlighted in green in table 1.2 and table 1.3

highlight those risks relevant to the likelihood and severity in SOE's particularly relevant to this research i.e. SOE funding to support an effective infrastructure investment programme.

This study sought to identify the primary reasons that Transnet was losing investor confidence specifically with respect to capital investments in infrastructure. It investigated the reasons for variance between planned and actualized capital expenditure as evidenced in the capital expenditure reports and the most relevant factors that influence decision making and project selection.

Table 1.2: SWOT analysis of Department of Public Enterprises (DPE Strategic Plan, 2017)

STRENGTHS	WEAKNESSES
Dedicated, skilled and competent workforce	Shareholder management model not finalised
Overseeing companies that are the cornerstone of the economy	Lack of common view of shareholder oversight
Strong financial management systems and practices	Lack of clarity on roles and responsibilities
OPPORTUNITIES	THREATS
Position the minister as an 'activist' shareholder representative	Not all enabling sector policies and legislation are in place
Stimulate economic growth through infrastructure rollout programme	Recapitalization of SOE in a constrained fiscal policy framework
Drive SOE transformation	Low economic growth
Drive industrialization and localisation	Absence of a clear legislative framework setting out the DPE's shareholder mandate
Development of a new organizational model and functional structure in line with the strategic objectives set for the Department's new Medium Term Expenditure Framework	
Alignment with other government policy departments e.g. Alignment with DOE on Eskom	

Table 1.3: Risk analysis of Department of Public Enterprises (DPE Strategic Plan, 2017)

STRATEGIC RISK	DESCRIPTION
Coherent strategic intent	Ability to formulate strategic intent on each SOE after robust stakeholder engagement process Ability to communicate strategic intent to SOE aligned with a set of outcomes and crucial output measures based on the strategic priorities identified in the MTSF
Shareholder/ board governance	board and senior management competence and ability to interpret SOE mandate and apply its resources in meetings its mandate in an effective; efficient and economical manner
Preservation and growth of shareholder value	Greater SOE productivity and asset effectiveness to increase revenue and profit and achieve operational excellence with optimal economic impact of SOE activities on their respective sectors and the broader economy

SOE funding	Ability to provide shareholder support for SOE to access capital from external sources and leverage status as sovereign shareholder Ability of SOE to be self-sustainable (ability to generate sufficient profits to remain solvent and repay loans)
Responsiveness to external factors	Impact of uncontrollable economic factors (foreign exchange rates; inflation; interest rates; labour unrest) on SOE revenues, debt and costs
Effective stakeholder consultation	Understanding stakeholder expectations in relation to the SOE environment and government's strategic objectives
Effectiveness/ efficiency of the infrastructure investment programme	The infrastructure investment programme might not be delivering the desired targets in terms of addressing capacity constraints (planned progress and completion; budgeted costs; private sector participation; local spend; skills development; job creation etc.
Operational efficiency	Having efficient and effective officials, processes and systems to enable DPE to fully deliver on its mandate
Legal and regulatory compliance	Non-compliance by the Department and its portfolio of SOE with relevant laws, regulations, directives, protocol, contractual provisions, etc.

1.2.3 The Ports Authority context and trends

1.2.3.1 South African Ports Today

The Southern African ports play a valuable role in stimulating the economy of South Africa with extended positive influence on the economics of neighbouring landlocked members of the Southern African Development Community (SADC). Fraser, Darren, Notteboom and Theo (2016), had identified significant economic opportunity within the South African Marine Transport and Manufacturing (MTM) sector. These included:

- ❖ South Africa has nine SOEs including commercial ports perfectly positioned with opportunities to grow the MTM sector
- ❖ On average, there are an estimated 13 000 vessels docking in South African ports with traffic volumes of approximately 130 000 passing through South African Waters each year. This equates to approximately 300 million tons of cargo being shipped through South African ports each year.

Figure 1.3 illustrates that South Africa is uniquely positioned to leverage its infrastructure, location, expertise and existing downstream industry to service the maritime sector as the logistics provider of choice on the African continent.

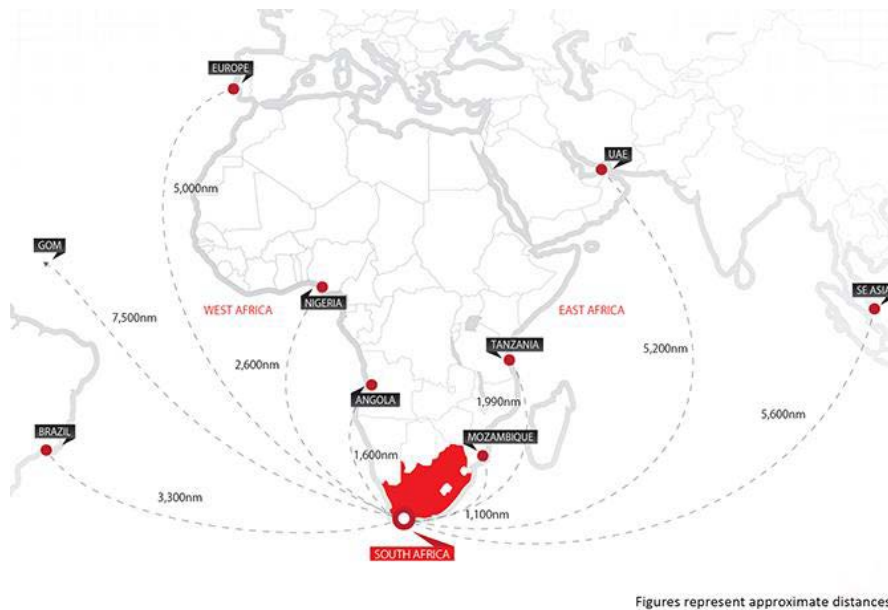


Figure 1.3: An illustration of South Africa's positioning for economic influence

South African ports provided a vital trade link for an estimated 95 percent of all trade to East Africa (Fraser et al, 2016). South Africa therefore formed an integral link to the logistic chain for Southern Africa with a domino effect on the entire region when any delays or interruptions were experienced in South African ports. Fraser et al (2016) had cited examples, where in the recent past, South African ports became more settled with the transition from privatisation to largescale government investment. This resulted in more efficient cargo handling procedures. Improved infrastructure investments facilitated improved service delivery levels. Positioning the port structure under the ownership of state-owned entities provided stability, and assurance in the midst of a volatile and influential labour force. The Ports Authority, a division of Transnet Pty Ltd, prided itself on a brand image of customer focus; reliability and flexibility; cost-efficiency and competitiveness; transparency; improved communication and divisional alignment; and an integrated solution of bulk freight transportation (Transnet Integrated Report, 2017). Figure 1.3 illustrates the high level Tree Diagram illustrating the organizational structure of Transnet and detailing the Project Management Office, within the Ports Authority, which was the focal point of this research. Transnet comprises five operating divisions with emphasis on freight rail; rail engineering; the port landlord; port terminal operations and pipelines. The Ports Authority is one of the five operating divisions of Transnet and is the only regulated division within Transnet. The Ports Authority is responsible for the safe, effective and efficient economic functioning of the national port system, which it manages in a landlord capacity. The Ports Authority targets its service offering at port users (which include terminal operators, shipping lines, ship agents, cargo owners and clearing & forwarding agents). As such, it manages the eight commercial seaports along South Africa's 2,954-km coastline. These ports are Richards Bay, Durban, East London, Ngqura, Port Elizabeth, Mossel Bay, Cape Town and Saldanha. The National Ports Authority in South Africa provides a service offering divided into two major categories: (1) The provision of port infrastructure; and (2) The provision of maritime services. Maritime services include dredging, aids to navigation, ship repairs and marine operations. It operates within a legislative and regulatory environment created by the National Ports Act 2005 (Act No. 12 of 2005). In line with the provisions of the National Ports Act (Act No. 12 of 2005), the core functions of the Ports Authority are as follows:

- ❖ To plan, provide, maintain and improve port infrastructure;
- ❖ To provide or arrange marine-related services;
- ❖ To ensure the provision of port services, including the management of port activities and the port regulatory function at all south African ports; and
- ❖ To provide aids to navigation and assistance to the manoeuvring of vessels within port limits and along the coast.

The Ports Authority seeks to continue in its role of facilitating trade, influencing economic growth by provision of port infrastructure ahead of demand; and responding to changing market dynamics by aligning its core activities and daily operations with the market (Transnet Integrated Report, 2017).

1.2.3.2 Ports Authority Objectives

The National Ports Act, (Act No 12 of 2005) became effective in November 2006 and gave birth to the Ports Authority, a division of Transnet, a State-owned Entity in South Africa. The Ports Authority is a landlord port authority, similar to other major global ports and is responsible for the management of the port system. The Ports Authority uses concession agreements, leases, and licences and permits to appoint port operators. The Ports Authority functions as a regulator of all port services and facilities and thereby ensures integration into the wider transport and logistics chain. As a regulated entity, the Ports Authority is regulated by the Ports Regulator within three levels of regulation and control, namely, regulatory oversight; economic regulation; and port operations oversight. The Ports Authority's strategic focus is aimed at creating a smart, globally competitive port system that is focused on serving as a catalyst for investment and economic growth.

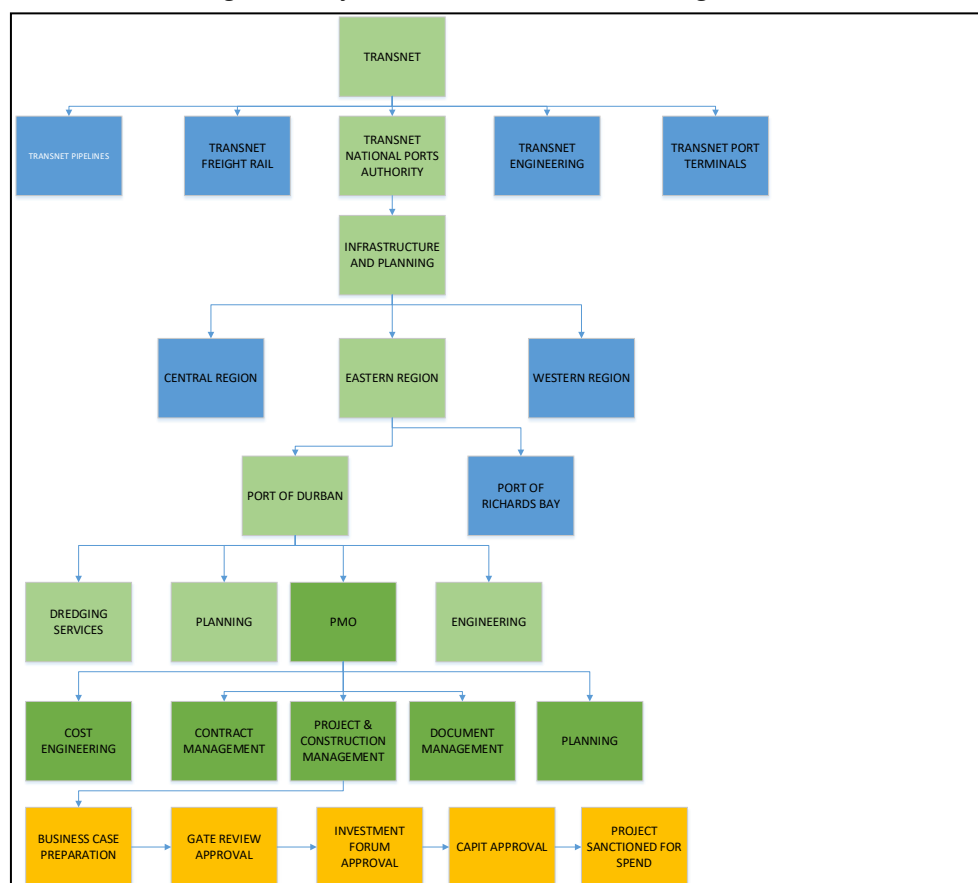


Figure 1.4: Tree Diagram illustrating the organization structure of the Transnet

1.2.3.3 The Port Development Framework Plan

The National Ports Act, (act no. 12 of 2005) creates a dual role for the Ports Authority. The port regulatory function is aimed at controlling the provision of port services through licensing or agreements with port operators to ensure that efficient port services are provided. The National Ports Act (act no. 12 of 2005) also establishes the Ports Regulator of South Africa (PRSA) who is charged with the responsibility of

- ❖ exercising economic regulation of the ports system in line with the government's strategic objectives;
- ❖ promoting equity of access to the south African commercial seaports and to the facilities and services provided by these ports;
- ❖ Monitoring the activities of National Ports Authority to ensure that it performs its functions in accordance with this Act; and
- ❖ Hearing complaints and appeals under the National Ports Act. (2005)

The Ports Authority had developed a three-tier strategy aligned with the SOE's Four-point Growth Strategy (Transnet, 2019), geared towards providing adequate port infrastructure capacity; efficient port operations management; and enhancing the ports' geographical positioning as a gateway for trade arising from the eastern and western seaboard. The new 4.0 strategy lends itself to the illustration in figure 1.4 showing the four directions in which companies can grow. The strategy aims to meet the growth demands of the South African port system and focus on delivery in three main areas:

- ❖ Timely delivery of capital investment projects to sustain and increase existing port infrastructure and marine capacity;
- ❖ Improved efficiency in port services to promote productivity; and
- ❖ Revenue growth and cost-effectiveness.

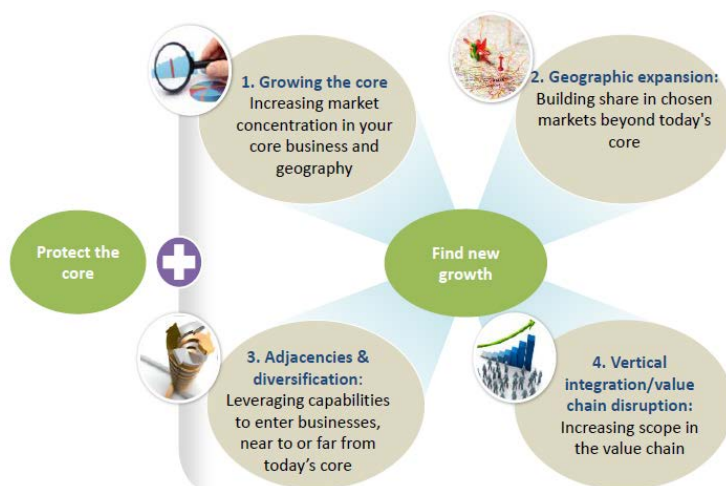


Figure 1.5: The four directions in which companies can grow, [Source: Transnet Integrated Report (2017)]

As shown in figure 1.6, the 4.0 strategy (which stems out of the 4th Industrial Revolution) is not driven so much by resource consumption as it is driven by technology and services.

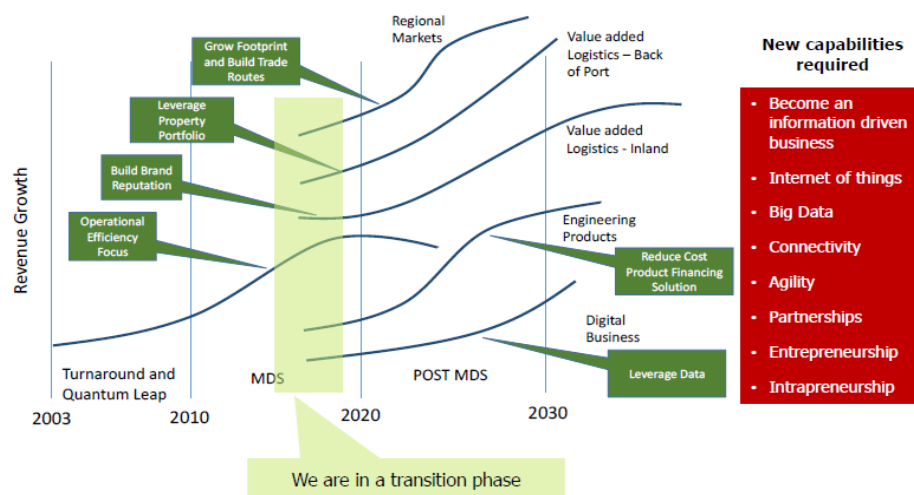


Figure 1.6: The transition from the MDS strategy to the 4.0 growth strategy, [Source: Transnet Integrated Report (2017)]

The 4.0 strategy aligned with the older Market Demand Strategy (MDS) shown in table 1.4 below, where the 4th industrial revolution highlights increased focus on geographic expansion into the rest of Africa, the Middle East and South Asia. Growth prospects have been poor in traditional markets and this fosters geographic and product diversification in product and service offering with emphasis on manufacturing capabilities. Transnet has recognised the need to reengineer its business as an integrated logistics service provider with a customer centric focus offering end-to-end solutions to key partners. (Transnet Integrated Report, 2017)

Table 1.4: – Ports Authority key initiatives for the 2018/19 financial year, Transnet Integrated Report (2017)

TNPA 2018/19 MDS KEY INITIATIVES (CORPORATE PLAN)	
MDS Key Focus Areas	Key Initiatives 2018/19
FINANCIAL SUSTAINABILITY	Reduce customer supply chain costs through commencing the implementation of the Tariff Strategy to rationalise tariff structures and address cross-subsidisation between various port services Implement the Port Tariff Incentive Programme - PTIP
CAPACITY CREATION & MAINTENANCE	Implement key infrastructure capital investment projects to create capacity for cargo volume handling;
OPERATIONAL EXCELLENCE	Align port performance standards (TOPS, ROPS, Haulier Operator Performance Standards) to terminal capacity
DEVELOPMENTAL OUTCOMES	Smart People's Ports Phase 1 - DBN; Phase 2 - all ports
MARKET SEGMENT COMPETITIVENESS	Create port capacity and attract private sector investment - execute Section 56 new business projects (as per approved list)

1.3 Problem statement

The infrastructure investment programmes were not interrogated for strategic fit, ranked or prioritized within the Ports Authority, South Africa. The Ports Authority used a corporate plan as a framework for project selection and prioritization in each financial year. The corporate plan was not a project prioritization tool recommended by international best practice due to its heavy reliance on financial modelling and no alignment with the organizational business objectives. Further, from recent trend analysis reports (Transnet, 2018), on average only 30% of the projects listed on the corporate plan were executed within any financial year. According to the Ports Regulator of South Africa, Durban was listed as the most expensive among 12 international comparable ports.

The Ports Regulator had been reluctant to support recent port tariff applications owing to the non-delivery of infrastructure by the Ports Authority to defend the annual tariff increase (Meyiwa and Chasomeris, 2016: 1-20) (Fakir, 2018: 1-58). In the past, poor project delivery caused capital investments to be classified as irregular expenditure, eroded confidence in the port's performance resulting in claw backs and tariff adjustments (Havenga, Simpson and Goedhals-Gerber, 2017: 1-13). The net effect of the substantial tariff reductions meant that the Ports Authority had to rely on foreign investment to finance infrastructure programmes.

1.3.1 Project lifecycle process

While the PLP framework used by the Ports Authority encouraged strategic alignment with the business objectives, the project selection tool was the corporate plan and had no requirement for strategic alignment of projects with business objectives. A deep dive into the portfolio analytics on the corporate plan as a project selection and prioritization tool, revealed the recurring issue that while the Ports Authority was intending to manage portfolios through the corporate plan, the fundamental requirement of selection and prioritization of projects were not addressed and the corporate plan was being used as a financial tool to forecast cash flows in each financial year and measure the projects progress relative to the planned budget (Yang and Notteboom, 2017:1-17). By PMBOK definition, the corporate plan should be the output of a portfolio selection plan to select, prioritize and rank projects of strategic importance to the business (PMBOK Guide, 2004). The process of project selection and prioritization guided by the PLP methodology was viewed as subjective as it placed a lot of accountability for project selection and prioritization in the hands of the project sponsor. The OECD (2014:1-33) emphasised the opportunity for bias and corruption when infrastructure investment decisions were made in this manner. Project sponsors were not held accountable or faced any recrimination for poor decisions, self-motivated causes, poor managerial and technical capabilities or project failure due to subjective investment decision making. The OECD (2014:1-33) also mentioned the irregular practices such as conflicts of interest and outright corruption that had been evident without an objective project screening and selection framework. For South Africa, the King Commission on Corporate Governance (2010) was developed and subsequently modified for State Owned Enterprises (SOEs) and had to some extent improved corporate governance in South Africa since 1994.

1.3.2 The corporate plan

Transnet's Long Term Planning Framework (LTPF) captured the capacity development and investment opportunities needed to ensure integrated development of rail, port and pipeline capacity. The LTPF was developed ahead of demand (NPP, 2019). Hence the LTPF guided strategic investment decisions based on capacity requirements not impacted by affordability, profitability and other business constraints. As set out in the Transnet Integrated Report (Transnet, 2018), the LTPF directed the development of Transnet's short term seven-year business plan (Corporate Plan). The Corporate Plan, unlike the LTPF, was intended to consider business risk, capital availability, implementation constraints and market commitments in determining the capital infrastructure execution plan over the next seven-year period. However, the corporate plan adopted only financial modelling to optimize and prioritize the portfolio of projects based on capital budgeting and affordability assessments. The projects listed on the corporate plan were driven by the scheduling of the investment decisions incorporated into the Port Development Framework Plans (PDFP, 2019) to plan, build and maintain port infrastructure assets. Over time, the bulk of capital projects listed on the corporate plan became focused on refurbishments and capitalized

maintenance rather than new infrastructure assets. The result was that the Ports Authority was not spending the capital that it should be investing to create new assets for growth and stimulation of the economy (Meyiwa and Chasomeris, 2016: 1-20). A quick review of the 7 year corporate plan reflected that the Ports Authority's investment plan was very top heavy on maintenance projects, with approximately a 60/ 40 split between maintenance and new infrastructure investment (Transnet, 2018). To remedy this situation, the Ports Authority needed to focus on projects that would drive strategic business objectives towards facilitating economic growth. Shareholders had raised concerns that the Ports Authority was not aligning to best practice for infrastructure in terms of what was happening in the international space (Ikome, Nguendi and Tama, 2016: 255-277). Stakeholders were not receiving return on investment as the tariff methodology and CAPEX investments were not an accurate, objective representation of the profitability index of capital investment projects. The Ports Authority was not really creating new infrastructure assets to stimulate the economy and accommodate new vessel demands and this motivated fundamental discontent within the Ports Regulator South Africa (Fakir, 2018: 1-58) (Havenga, Simpson and Goedhals-Gerber, 2017: 1-13). The further drawback was that Ports Authority profits were being diluted by cross subsidization of other Transnet operating divisions (Transnet, 2019) owing to their poor performance.

1.3.3 Best practice for project selection, ranking and prioritization

Project selection criteria and methodologies identify how projects are selected, ranked and prioritized (Wheeler, 2016: iii). Criteria often vary based on stakeholder requirements, market triggers and the strategic focus of the business (Stewart, 2016: 23-33). According to Stewart (2016) the criteria and methodologies could be categorized as financial, regulatory and sometimes even based on public perception or political perception. According to Trivedi, Ashish, and Amol Singh (2017:1-3), the selection methods may focus on measuring the tangible benefits of the project or a portfolio of projects. While decision models examined different criteria used in making decisions regarding project selection, calculation methods could be more complex in providing a way to calculate the value of the project, which was then used in project selection decision-making (Mohagheghi, Mousavi and Vahdani, 2016: 1-28). An article by Njue, Kyalo, Mulwa and Mbugua (2016) presented a conceptual framework to examine the interaction between organizational strategic thinking and the relationship between project selection and portfolio implementation using the Pareto analysis. The theory on Pareto analysis used the 80/20 rule of the Pareto principle as a simple technique in prioritisation of projects for the biggest economic impact. The theory of constraints, as introduced by Goldratt (1984) offered a comprehensive approach to identifying the constraints in the process of project selection and prioritization and progressively eliminating constraints in the journey towards continual improvement. Shukla, Mishra, Jain and Yadav (2016: 120-132) suggested that the Promethee method was the preferred project selection method and eliminated fuzzy logic in decision making. From the review of literature, most industries basically applied two project selection methods. Constrained optimization made use of mathematical models to analyse and compare projects for suitability. The more commonly applied method was the benefits measurements method. This method made use of financial modelling techniques of net present value, internal rate of return and payback period to analyse and select projects. This study sought to perform a detailed analysis of project selection, ranking and prioritization techniques to support strategic decision making thereby contributing to improved profitability and benefits realization of infrastructure projects within the Ports Authority.

1.4 Research methodologic approach

Manzoor (2016:1-4), Hodgins (2017:106-376) and Creswell and Clark (2017:67-72) recommend a study design using mixed methods research through exploratory sequential design as illustrated in Figure 3.5 where qualitative data from the first phase of the research are used to determine variables and questions that inform the quantitative data collection in the second phase of the research. The exploratory sequential design was ideally suited to the methodological aim of this study as shown in Figure 1.7 which illustrates the two phase process followed in conducting the study. Interpretivist research using a qualitative strategy was used to identify the project selection criteria where the researcher had to infer, in a subjective manner, the phenomenon under study and make conclusions (Saunders et al., 2012:168) (Galliers, 1991:1-4). The qualitative research explored an understanding of the current practice for project selection using the purposive expert sampling technique. The qualitative data analysis benchmarked the current practice to the guiding theory and global best practice on project selection and prioritization. As a deductive outcome of the qualitative analysis, the researcher developed a customized project selection model for the Ports Authority. The positivist research using a quantitative strategy was thereafter used for the purpose of testing the effectiveness of the project prioritization model that that was developed using the selection criteria identified through the qualitative research (Saunders, Lewis and Thornhill 2012:166). Triangulation of results using the Exploratory Sequential Design demonstrated validity of the research.

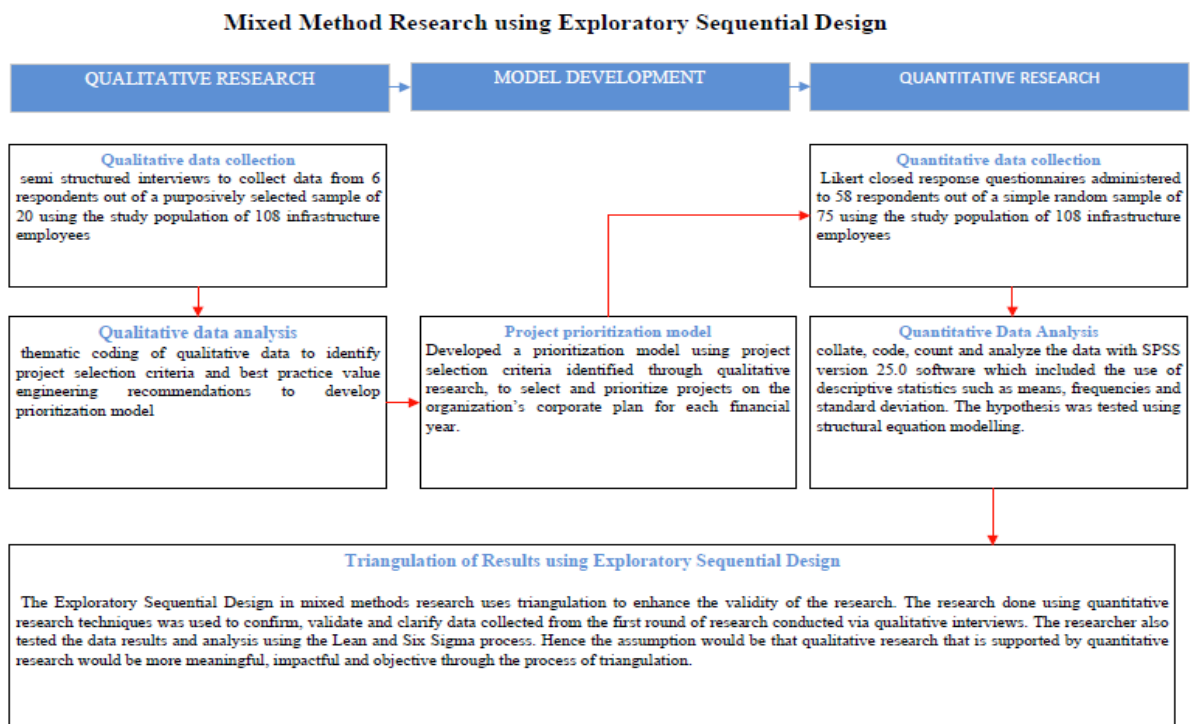


Figure 1.7: Mixed method research using Exploratory Sequential Design, [Creswell and Clark (2017:67-72)]

A total population of 108 employees within the infrastructure department constituted the study population involved or impacted directly by the capital approval process for infrastructure projects. Knowledge was consolidated from a qualitative sample size of twenty (20) experts within the study population of 108 employees with six (6) respondents based on subject matter expertise and experience (> 3 years) who form members of gate review, Investment Forum (IF) and Capital Investment Committee (CAPIC) approval forums within the National Ports Authority in South Africa. The quantitative sample was selected using simple random sampling where all attendees at all eight ports at Ports Authority, South Africa, were asked to complete closed response questionnaires of the Likert scale type. The questionnaire was not administered to non-attendees. The sample size was calculated at 75 (70% of 108) with fifty-eight (58) respondents. A confidence level of 95% was considered for this study with an acceptable margin of error of 0.05.

1.5 Scope of the study

1.5.1 Motivation for this study

This study encompassed a review of the selection and prioritization of infrastructure investment programmes by aligning the port objectives with the port tariff methodology. By comparison with international best practice, there was review into the project selection criteria and the project selection modelling that would contribute to sound infrastructure investment decisions at the Ports Authority.

Over the years, industries similar to the Ports Authority had developed sophisticated methods for project selection and prioritisation with the primary driver being business profits. The consequences of poor decisions in project selection could be enormously expensive and retard the business infrastructure growth and development, its competitive positioning and costs of doing business in the international freight logistics platform. Organisations often evolved their own investment screening process, based on technical concerns, available data, and corporate culture. To ensure monetary and other resources were utilised optimally to support the Ports Authority's objectives, a transparent, objective and quantifiable approach to prioritising capital must be applied through best practice project selection, ranking, evaluation and prioritisation techniques. In contrast to private industry practice, the Ports Authority selects projects from a political and socio-economic development standpoint. Projects were previously listed on the Ports Authority corporate plan for each fiscal year. This list of projects was not interrogated for business benefit, market demand, and strategy alignment or performance metrics. According to the Transnet 4.0 strategy (Transnet, 2019) and the National Ports Plan (NPP, 2019), the critical success factors for the Ports Authority's to effect improvements on its capital portfolio had been identified as:

- ❖ Earnings before interest, taxes, depreciation and amortization
- ❖ Revenue
- ❖ Cargo dues revenue

- ❖ Real estate revenue
- ❖ Marine services revenue
- ❖ Infrastructure maintenance
- ❖ Capital investment

Figure 1.8 is an extract from the Ports Authority Port Development Framework Plan (PDFP) (Transnet, 2019) and identified the key challenges for port planning and infrastructure development within the Ports Authority.



Figure 1.8 - the current challenges with project selection within the Ports Authority

There was therefore a need for research to be done to address the immediate business challenges in figure 1.7. This study identified the key challenges with project delivery within the Ports Authority and in so doing, developed a project selection methodology for contextual fit within the organisational environment. Weighted project selection criteria were identified and included in the project selection model to address the financial, regulatory, political and socio-economic requirements of the Ports Authority whilst adequately addressing the business need. Using project selection criteria to select and prioritize infrastructure programme for capital investment ensured that projects selected within the various portfolios assisted to protect revenue from port tariffs and ensure business sustainability for the Ports Authority. As a high performing state-owned entity, the Ports Authority would also assist with job creation in order to stimulate the South African economy and contribute to a growing gross domestic product, assist ports in becoming more efficient in its operations and services; become more responsive and agile in understanding and fulfilling customer needs and ensure that port infrastructure is reliable and compliant.

1.5.2 Summary of research design and methodology

The study used the mixed method Sequential Exploratory Design (Creswell and Clark, 2017) to identify the project selection criteria and develop the project selection and prioritization model as an outcome of qualitative analysis as summarised in table 5.35. Thereafter the study used quantitative analysis to test the model in improving investment decisions at the Ports Authority. Using inferential statistics the study aimed to demonstrate the causal relationship between the dependent variable investment decisions (S3.1 to S3.4) (S4.1 to S4.12) with the independent variables, project selection criteria (S3.5) and project selection model (S2.1 – 2.6) and (S3.1 – 3.4). There were a total of 108 employees that constituted the study population that were involved or impacted directly by the capital approval process for infrastructure projects. The qualitative research was used to establish an

understanding of the processes that were being used to select projects for infrastructure investment based on the empirical and theoretical gaps identified in the problem statement. The qualitative research used the data collected from the six (6) respondents out of a purposive sample of twenty (20) participants who were members of the governance forums for capital investment in infrastructure project selection. The quantitative sample was selected using simple random sampling where all attendees that attended the workshops at all eight ports were asked to complete questionnaires. The sample size was calculated at 75 (70% of 108) based on historical attendance at similar workshops.

1.5.3 Value of the research

This study aimed to improve investment decision making in infrastructure investment programmes at the Ports Authority in South Africa. A project selection and prioritization model was developed and benchmarked to global good practice for project selection. The model was successfully implemented at the Ports Authority and has been used to interrogate decision making in capital investments since 2019. Prioritization of investment programmes immediately improved the tariff applications. Once projects were prioritized using the prioritization model, business cases became much simpler to approve since projects were already aligned with the strategic objectives of the business, were categorized and tacitly approved for investment when they were included in the business 10 year investment plan. The faster approval of business cases for capital investment reduced the governance ‘red tape’ typically considered problematic in state-owned entities such as the Ports Authority (Thomas, 2015: 448-470) (Fowowe, 2017:1-12). This in turn impacted improved project delivery on time and within budget. Resources were focused on the prioritized projects with approved business cases and this immediately started to improve project delivery and organizational efficiency. The Ports Regulator had more confidence in approving a tariff based on tangible performance metrics and approved business cases (Meyiwa and Chasomeris, 2016: 1-20) (Fakir, 2018: 1-58). Increased revenue in the form of tariffs meant more capital availability for infrastructure investments. Project delivery was not weighed down by increasingly expensive cost of capital through debt financing. Hence prioritization of infrastructure programmes for capital investment sought to reduce the cost of doing business with the Ports Authority thereby increasing its competitive advantage, improving investor confidence and satisfying the customer base. The project prioritization model encouraged objective investment decision making by reducing bias and propensities for self-enrichment and corruption within state-owned entities such as the Ports Authority. The model could easily be applied in other state-owned entities within South Africa, within the rest of the African continent and even globally.

By reviewing the empirical gap in literature this study developed a project selection model that demonstrated how portfolio theory could be enhanced and adapted for state-owned enterprises where the focus was not merely financial returns but also encompassed enterprise risk management, market growth and competitiveness, availability of skilled human capital and providing capacity ahead of demand. This study therefore demonstrated how portfolio theory could be adapted to align with the strategic objectives of the organization as opposed to having purely financial focus and thereby making infrastructure investment decisions more lucrative to all stakeholders.

1.5.4 Limitations of the study

The prioritization model was implemented for the selection, ranking and prioritization of capital investment projects in the project lifecycle feasibility (FEL 3) and execution phases (FEL 4) of the project. The study assumed

that due diligence was applied in the conceptual, initiation and pre-feasibility phases of projects which were not funded out of capital investment but rather from operational expenditure. The limitation to this assumption was that organisations, such as the Ports Authority, often expended vast resources in terms of time, money and personnel on extensive optioneering of projects without carefully applying the selection and prioritization techniques recommended in this research. Once the optioneering phase was complete and the project was ready to progress into execution, organisations were remiss to defer or cancel these projects. The challenge is that without clear performance metrics and project selection criteria any expenditure that is irregularly or, fruitlessly and wastefully employed is deemed a PFMA violation as per Public Finance Management Act No 1 of 1999 Government Gazette 40637 dated 24 February, 2017. Hence these projects naturally progressed to execution at the opportunity cost of projects and programmes that may have had superior strategic alignment with the business intent. Therefore, the biggest limitation of the study was alignment of the conceptual, initiation and pre-feasibility phases of projects to the strategic objectives of the organization, National Ports Plan, Port Development Framework Plans and Fleet Plans for the project prioritization model to be truly effective.

The study intends to minimize this limitation through its applicability in investment decision-making. While the project selection model was tailored for project selection and prioritization at the Ports Authority, the conceptual framework was based on the Analytical Hierarchical Process (Velasquez and Hester, 2013:1-11), which is a versatile technique in multi criteria decision-making. The model could be tailored for evaluation of investment decisions in any business environment provided the selection criteria was aligned with the business objectives.

1.6 Definition of key terms

Table 1.5 provides definitions for terms relevant to this document.

Table 1.5: Key terms and definitions

Term	Definition
Project	A project is a unique process consisting of a set of co-ordinated and controlled activities with start and finish dates, undertaken to achieve an objective conforming to specific requirements including the constraints of time, cost and resources (PMBOK Guide, 2004).
Programme	A group of related projects managed in a coordinated way to obtain benefits and control not available from managing them individually. Programs may include elements of related work outside of the scope of discrete projects in the program (PMBOK Guide, 2004).
Portfolio	A collection of projects or programs and other works that are grouped together to facilitate effective management of that work to meet strategic business objectives. The projects or programs of the portfolio may not necessarily be interdependent or directly related (PMBOK Guide, 2004).

Infrastructure investment	Capital approval process for funding capacity creation and sustainability initiatives
Project selection criteria	Selection criteria and methodologies identify how projects are selected, ranked and prioritized. Criteria often vary based on stakeholder requirements, market triggers and the strategic focus of the business (Stewart, 2016: 23-33)
Project selection model	A proven technique employed in a structured and objective approach to guide investment decision making in balancing the needs of the business with those of the customers and stakeholders (Gosenheimer, 2012:1-8)
Project selection, ranking prioritization	Selection methods focus on measuring the tangible benefits of the project or a portfolio of projects. Ranking allocates a score to weight the project's importance. Prioritization ranks the importance of projects based on their strategic alignment with the objectives of the organization (Mohagheghi, Mousavi and Vahdani, 2016)
PLP framework	The formal framework of corporate governance, dynamic management, internal controls and compliance toll gates (quality assurance) for each phase of project development, with due recognition of the minimum criteria that had to be satisfied prior to progressing into the next phase of the development process (PMBOK Guide, 2004), (Transnet, 2011)
Corporate plan	Transnet's short term seven-year business plan aligned to Transnet's Long Term Planning Framework (LTPF). Used as a project selection tool that adopted financial modelling techniques to select projects for implementation (Transnet, 2018)

The material presented in this study should be read in conjunction with related Transnet frameworks, policies, procedures and legislation, which include but are not limited to:

- Capital Portfolio Selection Policy
- Capital Portfolio Monitoring Control and Reviewing Policy
- Post Implementation and Financial Interim Reviews Policy
- Warrant Standard Operating Procedure
- Business Case Validation Procedures
- Post Implementation Reviews Standard Operating Procedure
- Financial Interim Reviews Standards Operating Procedure

- Capital Governance Framework
- Programme Management Framework
- Project Lifecycle Process (PLP) Framework
- Integrated Capital Projects/Programmes Assurance Framework (ICPAF)
- PLP, ICPAF & Gate Review Policy
- Public Finance Management Act (PFMA)
- Transnet Delegation of Authority Framework
- TGC Commercial Delegation of Authority Framework

1.7 Organization of the study

The study is presented in 6 chapters.

1.7.1 Chapter one – Overview of the study

This chapter introduces the study by setting the stage. The chapter presents the background of the study, the problem statement, the research aim and objectives, the scope of the study, definition of key terms used in the study and the organization of the chapters that constitute this study

1.7.2 Chapter two – Literature review

This chapter reviews literature aligned to the study. Through theoretical, empirical and conceptual analysis, the literature review in chapter 2 reviewed the key challenges with project delivery at the Ports Authority as well as the contributors to project selection and prioritization by reviewing the port objectives against the port tariff methodology and aligning them to the prioritization of infrastructure in South African ports. There was review into the types of decision making that would contribute to project selection at the Ports Authority and a comparison of the recommended good practices to ensure objectivity and good governance (Thomas, 2015: 448-470) (Fowowe, 2017:1-12). The research gap identified the weaknesses and strengths in the past empirical research with respect to the study objectives. The researcher also identified a methodological gap on the process for project selection and prioritization specific to the Ports Authority context by applying best practice recommendations from similar applications worldwide. In concluding chapter 2, the study developed a conceptual framework for this study and showed how the dependent and independent variables would be measured based on best practice theoretical frameworks for project selection modelling.

1.7.3 Chapter three – Research methodology

The research methodology in chapter 3 discussed the research design, philosophy, methods, strategies, population and sampling techniques, data collection methods, data collection instruments, analysis of the mixed methods research through exploratory sequential design. The research technique forced triangulation using the qualitative approach for data collection in the first phase of the research and quantitative approach for the second phase of data collection. The project selection criteria identified through data analysis of the qualitative data was instrumental in developing a project selection model that was implemented for the selection and prioritisation of infrastructure capital investment projects over a period of approximately six (6) months. The intention in analysis

of the quantitative research was to test compliance to and effectiveness of the model application in project selection and prioritization.

1.7.4 Chapter 4 – Data presentation, analysis and interpretation of findings: qualitative research and model development

Chapter 4 presented and discussed data analysis and interpretations of findings of the qualitative data that was collected through interviews. The significant and relevant themes were documented during the interviews and were presented in this chapter. Based on the empirical and theoretical gaps identified in the problem statement, this chapter discussed the data collection and handling from the six (6) respondents out of a purposive sample of twenty(20) research participants who were members of the governance forums for capital investment in infrastructure project selection. This section also discussed techniques adopted in the coding and analysis of the interview data transcripts together with any impediments experienced during the research. The findings of the qualitative research determined the key project selection criteria used to develop the model for selection and prioritization of projects. These criteria were used to benchmark the current practice against the best practice in relation to the selection, ranking and prioritization of projects at the Ports Authority.

1.7.5 Chapter 5 – Data presentation, analysis and interpretation of findings: quantitative research

In chapter 5, the responses to the quantitative questionnaires were analysed in detail. The analysis included reliability statistics, descriptive statistics and inferential statistics to support the interpretation of the quantitative findings. Cross tabulations and correlations were performed against the biographical data for a deeper understanding of respondent's feedback. Interpretation and findings from the data analysis were shown to be an accurate reflection of the participant's knowledge and experience to confirm credibility, transferability and dependability of the data analysis and interpretations.

Using inferential statistics the study aimed to demonstrate the causal relationship of the main components to business success defined as strategic alignment (S3.1 to S3.4) and improved investment decisions (S4.1 to S4.12) with the independent variables, project selection criteria (S3.5) and project selection model (S2.1 – 2.6) and (S3.1 – 3.4). Therefore quantitative and qualitative analysis proved that the results did not occur by chance hence H_0 was rejected. The mixed method analysis therefore triangulated findings from the qualitative and quantitative analysis in proving the hypothesis that project selection criteria does influence project selection and prioritization for improved investment decisions at the Ports Authority.

1.7.6 Chapter 6 - Summary of findings, conclusion and recommendations

In chapter 6, the study concluded findings from the qualitative and quantitative research used in this study. Findings from the qualitative and quantitative analysis were triangulated. The outcome of the quantitative research was also intended to assess if there was improvement in capital spend on infrastructure development after adopting good practice in implementing a model to objectively select and prioritize projects. This improvement in capital expenditure translated into business success in meeting the requirements of the Ports Regulator South Africa. In almost every instance respondents agreed that there was an improvement in operations after the project prioritization model was implemented. Improvements were indicated in the areas of strategic alignment between business operations and infrastructure development, governance and due diligence, objectivity in screening and

prioritising projects and the impact on investment decisions and by extension the Ports Authority customer responsiveness. The study endeavoured to make meaningful recommendations and implement solutions to address any drawbacks in the implementation of project selection and prioritization within the Ports Authority, in the spirit of continual improvement.

1.8 Chapter summary

This chapter introduced the background to this research and set the context to attract investor funding for capital infrastructure development at the Ports Authority as a stimulus to economic growth in South Africa. Chapter 1 also summarised the research aim and objectives. It was important to note that the aim of the research was limited to identifying the criteria for project selection in the Ports Authority as an input to developing and implementing a model for project selection and prioritization. The scope of the study and its limitations were also covered in this chapter.

The next chapter delineates the research gap. It includes a theoretical review of the theories and models that the study was anchored on.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter introduces terms and concepts discussed within this study. This was followed by a theoretical review that consisted of theories and models that the study was anchored on. These models and theories directly supported the study variables identified in the research objectives. The empirical review was a detailed interrogation and dialogue of past empirical studies of the study variables captured by the study objectives. The research gap identified the weaknesses and strengths in the past empirical research with respect to the study objectives. The chapter also identified a methodological gap on the process for project selection and prioritization specific to the Ports Authority context. In concluding this chapter, the chapter developed a conceptual framework for the current study and showed how each variable would be measured based on best practice theoretical frameworks for project selection modelling.

2.1.2 Projects

According to the Guide to the Project Management Body of Knowledge (Singh, 2019:11), “A project was a temporary endeavour undertaken to create a unique product, service or result”. Shepherd, Patzelt, Williams, Warnecke (2014:1-43) agree with this definition. Syn (2019:1-21) describes projects as a temporary change within the organization. This implies that a project was temporary and comes to an end once the project objective has been achieved. The process of managing a project includes initiating, developing, monitoring and controlling the project in line with the approved project plan. The project is handed over to the sponsor once the outputs were achieved.

2.1.3 Programme

By contrast, a programme was defined as a group of related or similar projects that were coordinated to leverage the benefits and control of managing these projects together (Syn, 2019:1-21)) (Morris and Pinto, 2007: 54-98). This means that in a programme there were multiple projects with similarities, dependencies or interdependencies. The centralized coordinated management of the interrelated or interdependent projects as a programme to achieve its strategic objectives was referred to as programme management (Singh, 2019:15). The programme management objective was the seamless management of interdependencies through optimal resource utilization among projects and reduction in the constraints so as to increase the organization’s performance. In most SOE’s programme management was very much in the introductory phase hence the business fails to realize the synergies in the contracts and procurement pipeline, optimization of internal and external resources, schedule and cost (Wentwortha and Makokerab, 2015: 4).

2.1 4 Portfolio

Wentwortha and Makokerab (2015: 4) describe a portfolio as a number of programmes of projects grouped together for synergies in execution. The PMBOK 6th edition defines a portfolio as “a group of related or non-related projects or programmes. A portfolio can consist of multiple programs or multiple projects that can be non-similar.....” (Singh, 2019:15) The intent in portfolio management was to respond directly to the business

objectives and it was therefore imperative to identify, prioritize, and authorize the projects, or programmes, to achieve the organization's strategic business objectives.

2.2 Theoretical review

The theoretical review consisted of theories and models that the study was anchored on in support of the study objectives.

2.2.1 Project lifecycle process

Transnet (2011) had adopted the Project Life-cycle Process (PLP) as its project methodology for the effective management of major capital infrastructure projects. As illustrated in Figure 2.1 and 2.2, the PLP methodology aligned, for the large part, with the formal framework of corporate governance, dynamic management, internal controls and compliance toll gates (quality assurance) for each phase of project development, with due recognition of the minimum criteria that had to be satisfied prior to progressing into the next phase of the development process (PMBOK Guide, 2004), (Transnet, 2011).

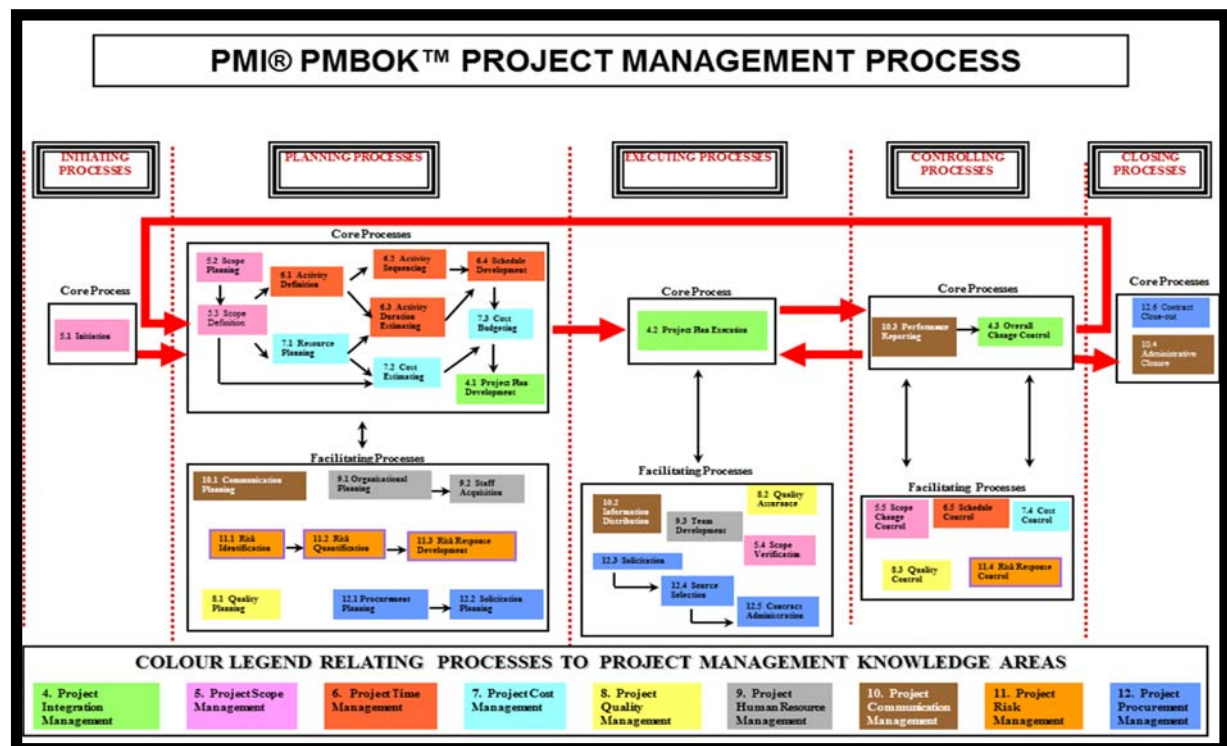


Figure 2.1: Process Mapping based on PMI® PMBOK™ Project Management Process [PMBOK® Guide – Sixth Edition (2004)]

TNPA CAPITAL INVESTMENT PROCESS MAPPING						
7yr Capex Budget		Concept – FEL 1	Pre-feasibility – FEL 2	Feasibility – FEL 3	Execution FEL 4	Finalize – Close Out
Purpose	Portfolio Balancing ; Project Prioritization	Confirm business need ; Identify options	Select preferred / recommended option	Plan execution of selected /preferred option	Detail equipment design ; Executing Erection / Building ; Commissioning	Handover & Close
Key Activities	Classification ; Consolidation ; Budgeting	Aligning ; Identifying ; Optioneering ; Evaluating ; Reporting ; FEL 1 Gate Review	Aligning ; Prioritising ; Developing ; Evaluating ; Reporting ; FEL 2 Gate Review	Establishing ; Planning ; Estimating ; Engineering ; FEL 3 Gate Review	Planning ; Estimation ; Engineering ; Design ; Specification ; Procurement ; Construction ; Manufacturing ; Project Management ; FEL 4 Gate Review (if applicable)	Performance confirmation ; Commissioning ; closing ; Documentation ; Acceptance ; Commercial & Financial Closure
Deliverables	TNPA CAPEX 7yr Budget ; Annual Budgets ; Appropriation Request ; (AR)	Identify /Generate options ; Owner Requirement Specification (ORS) ; Concept Document ; Gate Review Report ; FEL 2 work plan	Pre-feasibility Report ; Owner Requirement Specification (ORS) ; Prelim design for study options ; Gate Review Report ; FEL 3 work plan	Final Business Case ; Feasibility Report ; Prelim Project Execution Plan (IPEP) ; Operational Readiness Plan (ORP) ; Gate Review Report	Procurement /Tender Documentation ; Drawings ; Specifications ; Construction of Asset	Completion certificate ; As built drawings ; Manuals ; Procedures ; Close out report ; Hand over certificates ; Completion Certificates ; PIR Plan
Engineering		0 % to 5 %	10 % to 30 %	40 % to 70 %	60 % to 100 %	
Estimate Range	SPCM Over FEL 1 : +8.2 % ; FEL 2 : +1.2 % ; FEL 3 : +1.2 %	-50 % to +50 %	-20 % to +20 %	-10 % to +15 %	-5 % to +10 %	
References	Capital Investment Policies	Conceptual Study Phase (FEL 1) Manual ; Gate Review Manual	Pre-feasibility Study Phase (FEL 2) Manual	Feasibility Study Phase (FEL 3) Manual	Execution Phase (FEL 4) Manual	Close Out Phase Manual

Figure 2.2: Project Life-cycle Process (PLP) Flow Diagram extracted from the PLP framework, [Source: Transnet, 2011]

2.2.1.1 FER - front end research

According to the PLP guideline (2011), the intended purpose of the FER stage in the project lifecycle was to identify and confirm the need for the project by assessing alignment with the business strategies and goals. Market research was usually undertaken to ascertain the progression to concept studies. Although many projects may have been initiated and closed in the boardroom either during strategic planning sessions or other means, any person within the employ of the Ports Authority could initiate the development and implementation of projects. Project selection was therefore driven by a future known demand or opportunity or due to deficiencies in the systems. Following a request to pursue a project undertaking in order to resolve a particular problem, deficiency or to take advantage of providing the infrastructure ahead of demand, the relevant department manager must review the request. He/she must confirm whether such request was in the benefit of the organisation and was in alignment with Market Demand Strategy (MDS) (Department of Transport, 2017), Port Development Framework Plan (PDFP, 2019), National Ports Plan (NPP, 2019) and other relevant business strategies. The strategic planning at the Transnet Executive Committee (EXCO) level resulted in a set of organisation imperatives and goals. The general managers and business unit managers were expected to convert these goals into business strategies. The Enterprise Portfolio Management Office (EPMO) within the Ports Authority, in collaboration with business managers, were expected to oversee the formulation and implementation of business strategies and facilitate project proposals i.e. FER's and business cases as well as the ranking and prioritisation of projects. After screening of projects and consolidation of the project portfolio, the EPMO, through application of the project lifecycle process, delivered the expected project outcomes. When the department manager had satisfied himself/herself of the requirements of the project request, the relevant departments both at the port and head office (Planning, Strategy and EPMO) were notified of the need for the project.

2.2.1.2 FEL 1 – concept phase

According to the PLP guideline (2011), the primary aim of the FEL1 phase was to develop and assess a defined strategic need or investment opportunity to tailor the suitability and attractiveness of the business case. This phase helped to identify and select the agreed number of options to be assessed during the pre-feasibility phase (FEL 2), should the strategic need or investment opportunity warrant further investigation. Business planning was performed, and relevant concepts formulated with early options for infrastructure development opportunities identified in line with the Port Development Framework Plan (PDF, 2019) and National Ports Plan (NPP, 2019) and approved. The PLP methodology and quality management practices within the Ports Authority were guiding principles to the current method of project selection and prioritization within the Ports Authority. A decision to award projects to managing contractors was informed by the in-house capacity constraints of the Ports Authority to deliver based on the availability, work loading and experience of the required resources. The project sponsor was accountable for the outputs of the FEL 1 projects and ensuring that the desired outcomes were achieved to the satisfaction of the approved owner requirement specification (ORS).

2.2.1.3 FEL 2 – pre-feasibility study

According to the PLP guideline (2011), the primary aim was to select the best or preferred option in line with the Ports Authority business needs and strategy. The proposed options and alternative solutions were assessed and approved in line with Port Development Framework (PDFP, 2019) and National Ports Plan (NPP, 2019). The Project Manager, Engineering Manager and Business Unit Manager shall review the scope, risk exposure, type and number of human resources that shall be required to execute this phase. A work plan for FEL 2 was detailed and adequately resourced. The master project plan included the scope management plan, time management plan, human resource management plan, quality management plan, risk management plan, communication plan, cost management plan, procurement management plan, and finally the integration management plan. Upon approval from the capital investment committee at the port, the gate review team and the project sponsor, the project was initiated and this marked the commencement of the feasibility studies. The project sponsor was accountable to confirm the requirements of the project and update the ORS at each project approval gate.

2.2.1.4 FEL 3 – feasibility study

According to the PLP guideline (2011), the principal objective of FEL 3 was to determine only the most beneficial, achievable and affordable option for the project in order to align with business strategic goals. The selected preferred option was evaluated in line with Port Development Framework (PDFP, 2019) and National Ports Plan (NPP, 2019) and approved. A work plan for FEL 3 was detailed and adequately resourced. The master project plan was detailed. The project sponsor initiated the commencement of the feasibility studies. He/she confirmed the requirements of the project and updated the ORS at each approval gate. The project manager was generally only appointed to the project in the FEL3 stage. He/she reviewed the project documents previously approved FEL 2 and confirmed the deliverables of the project relating to the scope of the project, roles and responsibilities, key performance areas and the state of completion and readiness of the project documentation to proceed into FEL 3. The Project Manager completed the project quality plan and obtains relevant sign-offs. Aghimein, Aigbavboa, Oke and Setati (2018:1-7) stated that late appointment of the project team does irrecoverable damage to the construction delivery schedule.

2.2.1.5 FEL 4 – execution

According to the PLP guideline (2011), the intended purpose of the FEL 4 phase was to manage all capital investment projects in an effective manner thereby ensuring that these were executed within the framework of the Ports Authority's minimum requirements for execution, and applicable statutory and regulatory requirements. The project manager, engineering manager and business unit manager reviewed the scope, risk exposure and human resources that were required to execute the FEL 4 phase. A Project Execution Plan and Construction Plan for FEL 3 was detailed and the project owner's team adequately resourced. Regular planning and scheduling meetings were convened at least every fortnight. Post Implementation Review (PIR) planning began at the beginning of the FEL 4 stage. Post implementation reviews on completed projects were in accordance with the standard operating procedures and / or legislative requirements. The PIR report was documented and agreed with key stakeholders. The post implementation review findings, as well as the project learning's were fed back into the business by means of a business validation report to support delivery standards and business planning for future projects. The PIR measured the business benefits achieved by the project implementation. Projects were reviewed at the point of capitalisation to ensure that assets had been classified correctly into separately identifiable units in the fixed asset register. Final acceptance included but was not limited to punch list items signed off, close-out report, registers and equipment certification to be handed over. The lesson learnt repository was updated for every completed project.

On review, the PLP methodology presented several potential drawbacks. For instance, the project manager was generally only appointed to the project in the FEL3 stage. This resulted in delays as the project documentation had to be reviewed, the project team appointed and familiarized with the project requirements before any work begins on the FEL 3 project deliverables. The PLP framework used by the Ports Authority was intended to balance the early business investment decision against any risk of a poorly defined scope that could result in costly delays during project execution. However the post implementation review was the only guiding process to review the achievement of the project goals alignment to the requirement of the capital investment decision. The PIR only took priority in FEL 4. Hence if the project had lost its strategic alignment to the business goals prior to the FEL 4 stage, the project would be prioritized for funding simply because it was on the corporate plan. Limits of authority had been delegated by the Board of Directors to the Transnet Group Chief Executive. In the interest of good corporate governance, approval structures had been established within the Ports Authority. Requests for approval followed the approved governing processes and structures for recommendation but the final approval rested with the delegated authority as reflected in the specific delegations set out in the Delegation of Authority Framework (DoA) framework. Capital expenditure could only be authorised if the project has been so approved by CAPIC in accordance with the limits set out in the DoA Framework and capital funds have been allocated on the corporate plan for the operating division. While the PLP encouraged strategic alignment with the business objectives, the project selection tool was the corporate plan and had no requirement for strategic alignment of projects with business objectives. A deep dive into the portfolio analytics on the corporate plan as a project selection and prioritization tool, leaned to the recurring issue that while the Ports Authority was intending to manage portfolios through the corporate plan, the fundamental requirement of selection and prioritization of projects were not addressed and the corporate plan was currently being used as a financial tool to forecast cash flows in each financial year and measure the projects progress to the planned budget (Yang and Notteboom,

2017:1-17). By PMBOK definition, the corporate plan should be the output of a portfolio selection plan to select, prioritize and rank projects of strategic importance to the business (PMBOK Guide, 2004).



Figure 2.3: Corporate plan focus areas within Transnet [Transnet, 2019]

The process of project selection and prioritization guided by the PLP methodology was viewed as subjective as it placed a lot of accountability for project selection and prioritization in the hands of the project sponsor. The OECD (2014:1-33) emphasised the opportunity for bias and corruption when infrastructure investment decisions were made in this manner. Project sponsors were not held accountable or faced any recrimination for poor decisions, self-motivated causes, poor managerial and technical capabilities or project failure due to subjective investment decision making. The OECD (2014:1-33) also mentioned the irregular practices such as conflicts of interest and outright corruption that had been evident without an objective project screening and selection framework. For South Africa, the King Commission on Corporate Governance (2010) was developed and subsequently modified for State Owned Enterprises (SOEs) and had to some extent improved corporate governance in South Africa since 1994. Many issues of concern remained with respect to corporate culture in the context of South African capitalism.

2.2.2 Gate review

According to the Gate Review Terms of Reference (2015), the Gate Review process was approved by both the Transnet Capital Investment Committee (CAPIC) as well as Board Disposal and Acquisition Committee (BDAC) in February 2014. The Project Lifecycle Process was an industry developed methodology that used the phased project lifecycle-based approach to target project delivery and reduce risks of project overruns and failure. The PLP framework incorporated a “Gate Review” at the end of each development phase before deciding on whether to proceed to the next phase. A Programme Framework had also been developed, which recognised Gate Reviews to be effected at both project and programme levels. The Gate Reviews were arguably the most fundamental part of the capital approval process for infrastructure investment projects and programmes within the Ports Authority. Thus Gate Reviews needed to be robust and thorough to provide assurance that projects and programmes were compliant with the PLP Methodology or Programme Governance Framework and were deemed acceptable to proceed to the ensuing phases. Table 2.1 below lists the fundamental criteria for project gate reviews within the Ports Authority. In a definite attempt to address and eradicate weaknesses, negatives perceptions, and misconceptions around Gate Reviews, the Transnet Gate Review Terms of Reference (2015) listed the following principles that had been established to govern the Gate Review Process;

- i. The Gate Review Process shall serve as a “Feeder Process” to CAPIC; hence, Gate Review Reports will be included as input to investment-decisions by Group/OD CAPIC and by Transnet Investment Forum;
- ii. Gate Review Panels were to operate independently from project teams (as per segregation of duties) and shall consist of senior and mature professionals formally appointed thereto; and
- iii. In additions to Technical (e.g. Engineering, Project Management, Health and Safety, Environmental) considerations, Gate Reviews shall include considerations of commercial, financial, legal and operational aspects, particularly so during the early phases (FEL-1 and FEL- 2, known as optioneering, at project level, and Programme Setup, at a Programme level).

Table 2.1: Fundamental Criteria for project gate reviews within Ports Authority [Source: Gate Review Terms of Reference, Rev 2, Transnet SOC Ltd, 2015]

Criteria for Review	Example of Applicable Considerations
Commercial viability	Is the market well defined? Was such market substantial and/or growing? Can competitive advantage be achieved? Were there commercial and/or socio-economic opportunities to leverage on? Is the project addressing a known business need? Have all non-capital solutions been explored? Was the project in line with the business strategy?
Technical viability	Is the product or proposed option-solution(s) technically feasible? Was the technology sustainable? Do we have, or can we acquire the needed technical knowledge and expertise? Was it reasonable to close the technical gap within a product development effort?
Financial viability	Is the projected financial return adequate? How likely were we to achieve the needed financial return? What were the financial risks?
Constructability	Can the product/facility be safely built in the time and cost required with currently available and accessible construction technology, expertise, and any other spatial constraints?
Operational viability	Will the organisation be ready to operate the final product / facility? What effect will this have on its current operations?
Risk management	Has all risks pertaining to business, operational, commercial levers been identified and adequate mitigation plans put in place.

This governance process was expected to ultimately contribute to a healthy investment portfolio and good practice for project delivery of capital projects across the Ports Authority. The fundamental drawback of the gate review process was that it did not interrogate the strategic alignment of the project or the process for project selection and prioritization as recommended by Cheshmberah, Makui, Seyedhoseini, and Yousefi (2011:216-226). The gate review panel only interrogated the project documentation for quality assurance in complying with the PLP methodology. However, the constraints with the PLP methodology, relevant to the study objectives, were mentioned earlier and were not addressed through this process of due diligence. Hence a project that was incorrectly selected and prioritized for capital investment would receive capital investment at the expense of a more deserving project as long as the project documentation met the quality assurance criteria of the gate review panel.

2.2.3 Current practice for project selection, ranking and prioritization

2.2.3.1 The corporate plan

Transnet's Long Term Planning Framework (LTPF) captured the capacity development and investment opportunities needed to ensure integrated development of rail, port and pipeline capacity was developed ahead of demand (NPP, 2019). Hence the LTPF guided strategic investment decisions based on capacity requirements not impacted by affordability, profitability and other business constraints. As set out in the Transnet Integrated Report (Transnet, 2018), the LTPF directed the development of Transnet's short term seven-year business plan (Corporate Plan). The Corporate Plan, unlike the LTPF, considered business risk, capital availability, implementation constraints and market commitments in determining the capital infrastructure execution plan over the next seven-year period. Hence the primary objective of the 7 year corporate plan was to optimize and prioritize the portfolio of projects based on capital budgeting and affordability assessments. The projects listed on the corporate plan were driven by the scheduling of the investment decisions incorporated into the Port Development Framework Plans (PDFP, 2019) to plan, build and maintain port infrastructure assets. Over time, the bulk of capital projects listed on the corporate plan became focused on refurbishments and capitalized maintenance rather than new infrastructure assets. The result was that the Ports Authority was not spending the capital that it should be investing to create new assets for growth and stimulation of the economy (Meyiwa and Chasomeris, 2016: 1-20). A quick review of the 7 year corporate plan reflected that the Ports Authority's investment plan was very top heavy on maintenance projects, with approximately a 60/ 40 split between maintenance and new business investment (Transnet, 2018). To remedy this situation, the Ports Authority needed to focus on projects that would drive strategic business objectives towards facilitating economic growth and therefore changing the approach towards planned preventative maintenance. Shareholders had raised concerns that the Ports Authority was not aligning to best practice for infrastructure in terms of what's happening in the international space (Ikome, Nguendi and Tama, 2016: 255-277). Each port developed an investment plan or corporate plan for their port and that got rolled up into the Ports Authority's corporate plan. The EPMO prepared and tried to implement a project ranking model of sorts. The ranking model ranking projects in order of importance to other projects, but not aligned to the strategic objectives of the organization. Hence maintenance projects could receive higher ranking scores than capital projects. Projects not justified by alignment with the business strategy could be prioritized for investment funding. The ranking model was also not aligned to business readiness dynamics. Hence a project could be prioritized for capital spending and then deferred because it was running behind schedule (Transnet, 2019). Unfortunately, the ports were not using the ranking model to select and prioritize projects to guide economic investment or to facilitate trade within South Africa. Each port was expected to have an investment plan strategically aligned to the growth initiatives in that particular commodity sector with the projects required to facilitate growth and improvement within that sector (PDFP, 2019). The Ports Authority tariff methodology was therefore aligned with sustaining existing infrastructure assets which had already paid off their asset investment value. The financial models used in CAPEX investments were therefore not an accurate, objective representation of the profitability index of capital investment projects. The Ports Authority was not really creating new infrastructure assets to stimulate the economy and accommodate new vessel demands and this motivated fundamental discontent with

the Ports Regulator South Africa (Fakir, 2018: 1-58) (Havenga, Simpson and Goedhals-Gerber, 2017: 1-13). The further drawback was that Ports Authority profits were being diluted by cross subsidization of other Transnet operating divisions (Transnet, 2019).

2.2.4 Best practice for project selection, ranking and prioritization

Selection criteria and methodologies identify how projects are selected, ranked and prioritized. Criteria often vary based on stakeholder requirements, market triggers and the strategic focus of the business (Stewart, 2016: 23-33). According to Stewart (2016) the criteria and methodologies can be categorized as financial, regulatory and sometimes even based on public perception or political perception. According to Trivedi, Ashish, and Amol Singh (2017:1-3), the selection methods may focus on measuring the tangible benefits of the project or a portfolio of projects. While decision models examined different criteria used in making decisions regarding project selection, calculation methods could be more complex in providing a way to calculate the value of the project, which was then used in project selection decision-making (Mohagheghi, Mousavi and Vahdani, 2016: 1-28). An article by Njue, Kyalo, Mulwa and Mbugua (2016) presented a conceptual framework to examine the interaction between organizational strategic thinking and the relationship between project selection and portfolio implementation using the Pareto analysis. The theory on Pareto analysis which uses the 80/20 rule of the Pareto principle was a simple technique in prioritisation of projects for the biggest economic impact. The theory of constraints, as introduced by Goldratt (1984) offered a comprehensive approach to identifying the constraints in the process of project selection and prioritization and progressively eliminating constraints in the journey towards continual improvement. Shukla, Mishra, Jain and Yadav (2016: 120-132) suggested that Promethee was the preferred project selection method and eliminated fuzzy logic in decision making. From the review of literature, most industries basically applied two project selection methods. Constrained optimization made use of mathematical models to analyse and compare projects for suitability. The more commonly applied method was the benefits measurements method. This method made use of financial modelling techniques of net present value, internal rate of return and payback period to analyse and select projects. The following were recognized and preferred approaches to project selection and classification.

2.2.4.1 Constrained optimization methods

This method made use of mathematical models that used linear, dynamic, integer, non-linear or multi objective programming in the form of algorithms (Wheeler, 2013: 6-10). In essence, constrained optimization methods used a specific stepped approach to solve problems. Constrained optimization was a complex process and required an engineering, statistical or mathematical background. This method was not very user-friendly for a large organization at a low project maturity level. It was used on projects with large complexity factors. The majority of private and public sector businesses that used project selection techniques, used the benefits measurement methods to make project selection decisions.

2.2.4.2 Benefits measurement methods

Benefit measurements refers to a more analytical and comparative approach to project selection (Wheeler, 2013: 6-10). It includes cost – benefit analyses, scoring models, benefit contribution methods that include various cash flow techniques, and economic models. The Standard for Portfolio Management (Project Management Institute, 2013) recommends various tools and techniques to select projects and optimise portfolios which include scoring models such as multi-criteria analysis to eliminate or deprioritise projects that do not meet the minimum threshold

scores (Benaija and Kjiri, 2016). The drawback of the benefit measurement method was the over reliance on financial performance indicators while not taking into account other capital investment dynamics such as regulatory compliance or health and safety compliance. In a state-owned entity, compliance to regulations and legislation was mandatory and not driven by cost-benefit analyses as per the National Ports Act, act number 12 of 2005.

2.2.4.3 Real options analysis

Real options analysis was a modern approach to corporate investment decision making. It was based on the premise that any corporate decision to invest or divest in assets was simply an option. The real options approach provided flexibility in decision making and presented the opportunity to treat capital investment as a discretionary right to invest based on the information available at the time (Govender, 2003). Net present value (NPV) was the intrinsic value of a real option. Through research, Govender (2003) stated that the traditional NPV criterion was most adept at analysing investment opportunities. The drawback with the NPV approach though, was that in SOEs such as Transnet, investments were not merely driven by profit margins. Hence this research investigated the key drivers for investment decisions and identified those project selection criteria well suited to the operating environment within the Ports Authority.

2.2.4.4 Multi criteria analysis

Benaija and Kjiri (2015: 1-11) described a methodical approach to project selection and classification based on the bedrock criteria used in the multi criteria analysis approach i.e. maximising the organization's value; balancing the portfolio (with a view to minimize the risk); and adjusting the portfolio to the organization's strategy (strategic alignment). This approach was likely the best option for state-owned entities such as the Ports Authority as it considered the contribution of projects to achieve the organization objectives as well as interactions between projects. In their article, Velasquez and Hester (2013: 1-11) reviewed eleven multi criteria decision methods: 1) Multi-Attribute Utility Theory, 2) Analytic Hierarchy Process, 3) Fuzzy Set Theory, 4) Case-based Reasoning, 5) Data Envelopment Analysis, 6) Simple Multi-Attribute Rating Technique, 7) Goal Programming, 8) ELECTRE, 9) PROMETHEE, 10) Simple Additive Weighting, and 11) Technique for Order of Preference by Similarity to Ideal Solution as shown in the table 2.2 below.

Through the research, Wheeler (2013: 1-89) reviewed various project and portfolio selection techniques and recommended the project selection approach in Figure 2.4. Wheeler recommended modifications to this approach for organisational fit particularly with respect to selection of investment programmes for government investment projects in China where recommendation was that the Standard for Portfolio Management included stronger links to the strategic objectives of government. While most MCDM methods were employed successfully in private industry as evidenced by Wheeler's article. This research recommended the Analytical Hierarchical Process (AHP) for project selection in SOEs as it appeared to be more integrative and able to accommodate strategic objectives of government, objective enough to guide the inefficiencies in decision making while still being adaptable to stringent governance processes and procedural delays particularly with financial management and procurement. Benaija and Kjiri (2015: 1-11) emphasized that the key to success in project selection and portfolio management was to use an interactive approach, through the intervention of decision makers, to define the selection criteria, maximize the organization's value; balance the portfolio (in order to minimize the risk) and finally to adjust the portfolio to align with the organization's strategy (strategic alignment).

Table 2.2: Summary of MCDM Methods [Source: Velasquez and Hester (2013: 1-11)]

Table 1. Summary of MCDM Methods

Method	Advantages	Disadvantages	Areas of Application
Multi-Attribute Utility Theory (MAUT)	Takes uncertainty into account; can incorporate preferences.	Needs a lot of input; preferences need to be precise.	Economics, finance, actuarial, water management, energy management, agriculture
Analytic Hierarchy Process (AHP)	Easy to use; scalable; hierarchy structure can easily adjust to fit many sized problems; not data intensive.	Problems due to interdependence between criteria and alternatives; can lead to inconsistencies between judgment and ranking criteria; rank reversal.	Performance-type problems, resource management, corporate policy and strategy, public policy, political strategy, and planning.
Case-Based Reasoning (CBR)	Not data intensive; requires little maintenance; can improve over time; can adapt to changes in environment.	Sensitive to inconsistent data; requires many cases.	Businesses, vehicle insurance, medicine, and engineering design.
Data Envelopment Analysis (DEA)	Capable of handling multiple inputs and outputs; efficiency can be analyzed and quantified.	Does not deal with imprecise data; assumes that all input and output are exactly known.	Economics, medicine, utilities, road safety, agriculture, retail, and business problems.
Fuzzy Set Theory	Allows for imprecise input; takes into account insufficient information.	Difficult to develop; can require numerous simulations before use.	Engineering, economics, environmental, social, medical, and management.
Simple Multi-Attribute Rating Technique (SMART)	Simple; allows for any type of weight assignment technique; less effort by decision makers.	Procedure may not be convenient considering the framework.	Environmental, construction, transportation and logistics, military, manufacturing and assembly problems.
Goal Programming (GP)	Capable of handling large-scale problems; can produce infinite alternatives.	It's ability to weight coefficients; typically needs to be used in combination with other MCDM methods to weight coefficients.	Production planning, scheduling, health care, portfolio selection, distribution systems, energy planning, water reservoir management, scheduling, wildlife management.
ELECTRE	Takes uncertainty and vagueness into account.	Its process and outcome can be difficult to explain in layman's terms; outranking causes the strengths and weaknesses of the alternatives to not be directly identified.	Energy, economics, environmental, water management, and transportation problems.

PROMETHEE	Easy to use; does not require assumption that criteria are proportionate.	Does not provide a clear method by which to assign weights.	Environmental, hydrology, water management, business and finance, chemistry, logistics and transportation, manufacturing and assembly, energy, agriculture.
Simple Additive Weighting (SAW)	Ability to compensate among criteria; intuitive to decision makers; calculation is simple does not require complex computer programs.	Estimates revealed do not always reflect the real situation; result obtained may not be logical.	Water management, business, and financial management.
Technique for Order Preferences by Similarity to Ideal Solutions (TOPSIS)	Has a simple process; easy to use and program; the number of steps remains the same regardless of the number of attributes.	Its use of Euclidean Distance does not consider the correlation of attributes; difficult to weight and keep consistency of judgment.	Supply chain management and logistics, engineering, manufacturing systems, business and marketing, environmental, human resources, and water resources management.

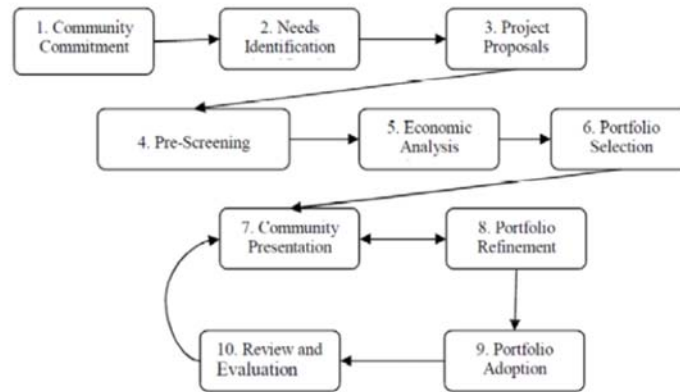


Figure 2.4: Project Selection Approach [source: Wheeler, 2013:12]

2.2.4.5 Analytical hierarchical process

As described by Velasquez and Hester (2013:1-11) the AHP framework was consistent with the methods of Multi Criteria Decision Making Methods and comprised the three step approach as follows:

- I. Identify and select criteria
- II. Weight the criteria and build consensus with respect to their contextual importance
- III. Evaluate the project proposals using the weighted criteria

A key characteristic of the AHP method was the use of ‘pair-wise comparisons’ that rely on expert judgement to derive priority scales that were scalable and adjustable in size to accommodate varying degrees of decision making problems (Velasquez and Hester, 2013:1-11). The AHP method does not allow individuals to perform comparative analyses in isolation without identifying comparative weaknesses and strengths of the selection. The AHP was used effectively in organisations and positioned as superior to other project selection techniques as it relied on the judgement of experts within the organisation to devise priority scales and this allowed contextual fit into the organisation. A further advantage was that the AHP was not as data intensive as other project selection methods, was easily scalable and adjusted easily to accommodate decision making problems. Butcher and Schutt (2016: 1-19) recommended the Promethean analysis in the technology selection framework at another Transnet operating division similar to the Ports Authority. The study, although beneficial in recommending a framework for implementation where there was none before, was limited in the factors to be considered in selecting, prioritising and validating technology. Hence, as a lessons learnt, the AHP was the preferred approach for project selection and this study used the AHP theoretical framework in the assessment of priority scales using the project selection criteria. The priority scales recommended through the AHP method closed the gaps for selecting, prioritising and validating project selection and prioritization with the Ports Authority.

2.3 Empirical review

The empirical review was used to interrogate previous study findings on the research objectives. By identifying the empirical and methodological gap in the literature the study took on the purpose of closing those gaps in proving the study hypothesis.

2.3.1 To identify the project selection criteria to improve project selection and prioritization at the Ports Authority in South Africa

2.3.1.1 Portfolio Theory

Wheeler recommended that “projects and programs selected by organizations should be consistent with strategic objectives for the organization; provide value for money and return on investment; be adequately resourced and prioritized; not compete with general operations for resources and not restrict the ability of operations to provide income to the organization; match the capacity and capability of the organization to deliver; and produce outputs that were willingly accepted by end users and customers” (Wheeler:2013:iv). The research also revealed the impetus that organizational culture and leadership had as the key contributors to optimal selection of projects. Wheeler concluded that organizations that neglected the relational impact of the underlying drivers of organization culture and leadership, would generally make sub-optimal decisions on the billions of dollars they invested in projects each year. Organizations were therefore challenged to measure project value both to the shareholder as well as the stakeholder. Many organisations such as the Ports Authority struggle to find the delicate balance between stakeholder value, competing resources and depleting capital funds in prioritising their project portfolios. Unlike the private sector, state-owned companies cannot assume that maximizing profit would maximize project value. An article by Sepehri (2013:1-10) stated that companies that evaluated projects by estimating impacts on cash flows and financial metrics alone ignored a significant component of the value derived from the project. For instance, a service company might conduct projects to enable it to honour commitments it makes to customers while a project that generates new knowledge that improves consistency of execution could reduce investment risk and hence attract even more shareholders.

According to Khambholiya (2020:1-14), Markowitz developed portfolio theory in 1955. In the earlier Markowitz portfolio selection models, the emphasis was on risk diversification to strengthen financial investments. The models focused on financial indices only. Since then, there have been several iterations of the Markowitz model as well as other research findings on similar portfolio selection models. These were discussed earlier under the theoretical review of multi criteria decision making models. A study by Silver (2019:1-7) showed that stakeholder wealth maximization was more encompassing than financial performance metrics. Silver stated that since the shareholder was only a component of the portfolio stakeholders, other stakeholder requirements such as regulatory compliance, job creation, safety and health requirements, operational efficiencies and capacity creation were also of fundamental importance to creating wealth for stakeholders. Silver also suggested that by merely looking at the financial indices, the organization was likely to invest in portfolios that did not improve organizational competitiveness, create a safe, compliant working environment or promote sustainability. Hence the project selection criteria should demonstrate strategic alignment with organizational objectives in order to improve business investment decisions (Silver, 2019:1-7). A selection model was a proven technique employed in a structured and objective approach to guide decision making in balancing the needs of the business with those of the customers and stakeholders (Gosenheimer, 2012:1-8). The best projects were the projects that create the most value (Rose, 2013:3) (Singh, 2019:1-6).

2.3.1.2 Project selection criteria

While the factors identified as critical to optimal project/ portfolio selection could be considered generic to the Ports Authority and recommended as good practice in the project environment in general, there was the obvious

requirement to consider specific drivers that contributed to project selection and decision making in state-owned entities. These differ somewhat from private industry within South Africa, Africa and the rest of the world. While challenging to change the Transnet culture and leadership, there were aspects of project selection that could be modified to make the selection process more objective, robust and fail proof. In support, Njue, Kyalo, Mulwa and Mbugua (2016:1-13) concluded in their research article that projects implementation continued to face challenges not limited to cost overrun, scope creep, ineffective stakeholder participation and poor quality of project deliverables which contributed to customer dissatisfaction, unfulfilled project objectives and loss of investment opportunities. The authors recommended that project selection should be a systematic and objective process with an aim of producing prioritized project alternatives so as to facilitate informed decision making on the choice of the most viable projects to pursue.

The key reason for portfolio selection was that the available portfolio funding requirements far exceeded the investment budget availability (Mohagheghi, Mousavi and Vahdani, 2016:1-28). While project selection criteria could be used to select and even rank projects by assigning weightings to the criteria. Project prioritization relied on strategic alignment of the selected / ranked project with the organizational objectives. Project selection models used across the globe vary depending on the critical success factors and demographic conditions of the business units involved in the multiple projects. Project selection models assist the organization in the prioritization of the project portfolio (Morton, Keisler and Salo (2016:1-43). While most of the literature reviewed for this research recommended project selection frameworks within the context of private organizations within the United States of America, Asia or Europe, several similar studies revealed that the factors identified could be generic to a state-owned entities such as the Ports Authority in South Africa. In a separate study, Nethathe, van Waveren, and Chan (2011:1-15) focused on contributors to project failure in parastatals within developing countries such as South Africa. The results reflected that the biggest deterrent to project success in parastatals was poorly defined project selection criteria as well as underdeveloped project processes and methodologies. The criteria and methodologies could be categorized as financial, regulatory and sometimes even based on public perception or political perception. According to Trivedi, Ashish, and Amol Singh (2017:1-3), the selection methods could focus on measuring the tangible benefits of the project or a portfolio of projects. Njue, Kyalo, Mulwa and Mbugua (2016:1-13) developed a model to examine the impact that organizational strategic thinking had on the relationship between project selection and portfolio implementation. As an outcome of this study, the model implementation provided a solid platform for improving compliance with best practice, organizational behaviour, and planning and policy development within the organization. Nonino (2017: 245-263) similarly conducted a study to show that a balanced portfolio was more likely to deliver on the strategic objectives of the company. This study also highlighted the dynamic impact of categorization and managing project interdependencies within portfolios. Korotin et al (2017: 50-58) and Mohagheghi, Mousavi and Vahdani (2016:1-28) also discussed in their studies how categorising projects would assist in balancing portfolios. It would also facilitate a simplified format for managing, controlling and measurement of deliverables for ease of stakeholder reporting. The prioritisation and ranking of projects within investment programmes would also give clear focus on the business critical or strategic projects to invest in or to defer during economic crises. Mohagheghi, Mousavi, Aghamohagheghi, and Vahdani (2017:1-22) recommend a fuzzy form of AHP for project selection model in the transport industry where the emphasis was the sustainability of the decision making criteria. They advised that while earlier models focused

on the financial criteria of projects, there had been increasing focus on looking at the strategic alignment, risk profiles, regulatory compliance and organizational readiness in addition to the addressing the strategic financial criteria in projects competing for funding sources. The Ports Authority's strategic objectives (figure 2.5) was determined by the Department of Transport (DOT, 2017), the Department of Public Enterprises, (DPE, 2018) the stakeholder holder requirements (PRSA, 2019) and the National Ports Act, act number 12 of 2005 (Government gazette, 2005). Therefore the guiding literature as well as the organizational objectives determine the project selection criteria to be used in the project selection and prioritization model. This study therefore identified those quick win project selection criteria aligned to the Transnet objectives.

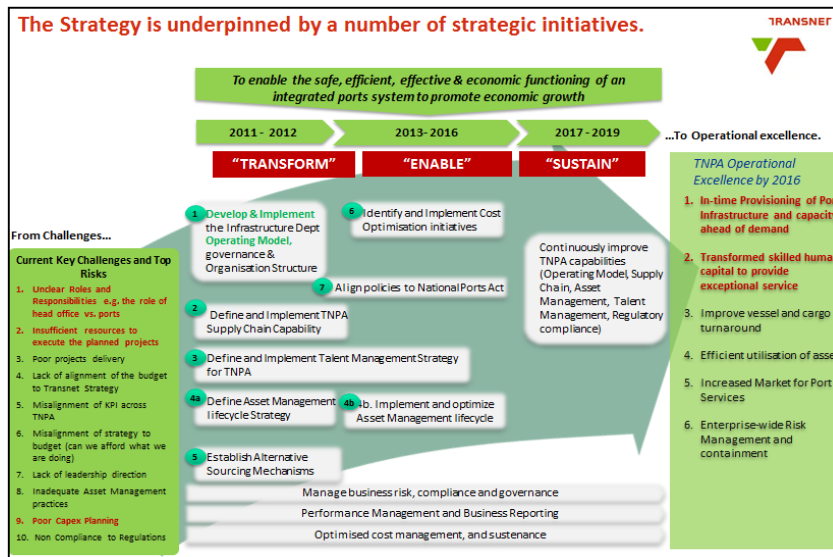


Figure 2.5: The Strategic Initiatives for the Ports Authority [Source: Corporate Plan FY 2019/2020]

2.3.2 To assess if the project selection model guides project selection to align with the Port Authority's strategic objectives

In his research, Mpofu (2016:1-21) concluded that the lack of strategic leadership had resulted in the challenges facing parastatals with regard to capital expansion and small projects that were executed without linking them to strategic objectives. This situation was aggravated by the blind loyalty to the PMBOK framework used by parastatals in executing projects. Mpofu's research methodology used in-depth interviews carried out within two South African parastatals, namely, Eskom and Transnet. The interviews were conducted with respondents who were involved in projects, ranging from senior executives down to project administrators. In the research, Mpofu (2016:1-21) found organisational structures within parastatals to be rigid and bureaucratic. The PMBOK framework that had been adopted proved inadequate. Major findings were that most projects were not linked to strategic objectives and that there was poor strategic leadership at all levels. Mpofu's study supported the intent of this research with the view that a rigorous process should be followed in ensuring that initiatives that become projects are, indeed, linked to the strategic objectives of the parastatal. In critique, Mpofu's research was repetitive in concluding similar results to other research in this field. There could have been valuable insight on how to link project selection with the strategic thrusts of the organisation. Further, the study was vague on defining the principles of measuring project success or failure in accordance with best practice or perception by investors.

Further, the Ports Authority did not have “blind loyalty” to the PMBOK process and as explained earlier, the PLP project methodology was used in adapting the PMBOK framework for its contextual environment within the Ports Authority. Mpofu’s research concluded similar results to other research in this field (Ajam, 2016) (Acciaro, 2013: 207-228). The research gap was identified in providing insight on how to link project selection with the strategic thrusts of the organisation. Further, the study was vague on defining the principles of measuring project success or failure in accordance with best practice or perception by investors.

The strategic initiatives of the Ports Authority were shown in figure 2.5. In order for the project selection model to guide strategic alignment when projects were selected, the project selection criteria must be aligned to the strategic initiatives of the business.

2.3.2.1 Enterprise risk management

Ndlozi (2016:1-87) delineated enterprise risk into construction risk, financial risk, legal risk, social risk, economic risk, commercial risk, monetary and environmental risk. His study recommended that a good project selection model should incorporate enterprise risk due to the port’s impact on economic growth. Ndlozi advised that port governance was integral to enterprise risk as it affected risk tolerance and expected returns. Findings from the online article by Mpinganjira and Roberts-Lombard (2016: 1-33), showed that state owned entities in particular had been slow to adjust to the merits of governance and ethics in fast tracking decisions to actualize sound corporate governance practices in order to deliver shareholder value. The most prevalent mechanism to control ethical conduct in SOEs was found to be ethical audits of processes and procedures as well as the training of staff. According to Mbele (2015:68), the environment within SOEs remains in distress as management struggle to maintain a balance between legislative compliance and performance. Hlotywa and Ndaguba (2017:1-12) had also proven that port infrastructure investment stimulated economic development. This study recommended that the risk management must include for thorough interrogation and performance management of the investment in order to have the intended impact on port efficiency, effectiveness and stakeholder management. Nyamita and Wekesa (2015:1-14) successfully implemented a project evaluation framework in Kenya, an African country almost the size of South Africa, and showed increased management of enterprise risk through the evaluation framework. As recommended by the authors, the project selection criteria had to incorporate enterprise risk management demonstrated through safety initiatives. Projects with improved safety levels were more likely to be prioritized since they reduced/ eradicated fatalities and injuries to staff and other port users. Regulatory and environmental compliance was also included in the selection criteria as it contributed to sustainable green ports. The projects were also selected if they scored well on enterprise risk which meant that the business risk impact of not doing the project was high.

2.3.2.2 Efficiencies

The strategic objectives of the Department of Public Enterprises (DPE, 2019), the Department of Transport (DOT, 2017) and the National Ports Plan (NPP, 2019) all drive the improved efficiency of vessel and cargo turnaround as well as efficient utilization of assets at the Ports Authority. These objectives were discussed in the introduction of this study. However, in order for these efficiency objectives to be achieved, there must be infrastructure development, growth and sustainability within the ports (Ndlozi, 2016:1-87). In the budget speech, as a precursor to the presidential State of the Nations Address in 2017 and again in 2019, the Minister of Finance, pushed for

radical socio-economic transformation by emphasizing that the infrastructure fund was the central pillar for reprioritization of the national budget. The recommendation was to promote involvement of the private sector and development finance institutions to catalyse R 526 billion worth of project spending of which the SOEs alone would be responsible for over R100 billion in the next decade (Gordhan, 2017:1-32). By contrast, Maseko (2014:1-14) stated that infrastructural development was a governmental responsibility. Efficient execution of infrastructure projects contributed directly and indirectly to economic and social development. Maseko recognised however that governments both in developed as well as developing nations were increasingly faced with constraints in delivering on their infrastructure mandate and responsibility. He recommended that proper planning before committing to projects would avoid project delays due to lack of funding. He emphasised that the public–private partnerships was not the silver bullet to remedy procurement delays in infrastructure development. Fraser and Notteboom (2016:53-54) researched funding options available to South African container ports, based on their respective institutional positions and port capacity requirements. The analysis reviewed the suitability of each port’s funding strategy with respect to sustainability for investment and capacity goals that were earmarked. Ultimately, the study tested the relationship between port institutional frameworks and sources of port funding in a developing country context. The findings indicated that the timing of capacity expansion and good assessment of future demand were crucial, not only to position the port for sustained growth, but also to secure the right funding sources for capacity expansions. Fraser and Notteboom (2016) supported Maseko (2014) in the finding that developing countries, in particular, were facing increased constraints on the level of public funding sources available to develop port infrastructure due to the existence of other national infrastructural and social priorities. These studies did not expand into identifying the social and economic priorities of South Africa and in particular into what were the Transnet specific constraints in supporting these priorities. As recommended by the studies that were reviewed, the project selection criteria included quantifiable operational efficiency where each project was required to demonstrate how it would promote volume growth or sustainability, promote customer satisfaction and improve market share in order to be prioritized for capital investment.

2.3.2.3 Market growth

Haralambides (2015:1-26) discussed recovery of infrastructure investment costs and the impact on economic development. According to Haralambides ports were placed in a very difficult position of having to recover investments in infrastructure, since after a port was built, its investment was “sunk” and would result in excess capacity if the assets were underutilized. All investment therefore needed to be recouped from shareholders. This can unduly increase the port tariffs and result in the ports becoming expensive and unattractive to its customers. High ports prices would hurt trade. However, if the port elected to keep costs down, the ports would struggle to recover on infrastructure investments. The attractive tariffs would increase traffic through the port but this could result in congestion Haralambides (2015:1-26). Further, extremely low port prices could result in subsidies but also be anti-competitive. Hence Haralambides recommended the delicate balance between demand and supply in regulating port prices. Public ports should not indiscriminately spend tax payer money on infrastructure investment without the mechanisms to recover on the investments. However, the recovery in investment did not have to be purely financial, it could also be through improved sustainability, compliance, improved skills development and job creation. In their article, Fraser and Notteboom (2016:53-54) reviewed developing countries, such as South Africa, that were facing many constraints in securing the right funding sources to develop

infrastructure within the ports given the more pressing social and national infrastructural priorities. Hence the accuracy of project estimates, and the prioritization of infrastructure projects, to secure public funding became critical to securing funding for the success of projects. On the 1 July 2016 a new standard was issued in terms of section 76(4)(c) of the Public Finance Management Act (PFMA), 1 of 1999, which allowed National Treasury to issue “regulations or instructions for the determination of a framework for an appropriate procurement and provisioning system which was fair, equitable, transparent, competitive and cost-effective”. The implications of this standard, apart from others, meant that public entities, such as Ports Authority, had to apply for condonation at National Treasury level when project budgets were exceeded and project estimates increased. This additional governance step placed a further burden on project delivery in terms of astute schedule and cost management. The PFMA regulation fosters the importance of demonstrable business readiness in project selection. To this end, the project selection criteria included finance and funding to measure the revenue growth and financial viability of the project to the infrastructure investment.

2.3.2.4. Skilled human capital

Jones, Mouraa and Domingos (2014:1-10) stated that properly valuing infrastructure investment meant looking at the most efficient utilization of resources in the cost benefit analysis of the investment. While the authors agreed that the value of life was “hard to determine”, they agreed that the residual value presented through job creation and skills development increased the investment viability. Therefore projects with greater opportunities for job creation and skills development should be prioritized over its competitors. The project selection criteria included for job creation and skills development where the project was required to demonstrate the direct project contribution to permanent creation of skills and jobs in the maritime environment.

2.3.2.5 Capacity ahead of demand

South Africa was historically guilty of a lack of investment in infrastructure, skills and development in capability (Ikome, Nguendi and Tama, 2016:255-277). Several government initiatives had been developed over the years to address these challenges. In particular, the New Growth Path [NGP] developed in 2010, aligned and built on previous policies to ensure the achievement of Government’s development initiatives for South Africa. The Ports Authority fully endorsed and supported the Government’s New Growth Path policy, the National Development Plan (NDP) and Operation Phakisa through its facilitation of Supplier Development [SD] initiatives. Odongo and Ojah (2016:1-21) have stated that while investors were very aware of the funding gap for infrastructure development in sub-Saharan Africa, weak governance within public infrastructure sectors have raised concerns over investment viability. Oniszczyk-Jastrzabek, Pawłowska and Czernański (2018:1-11) stated that the term green ports had been recently introduced and refers to ports that make investment decisions to “ensure compliance in all the three areas: economy, society and environment”. While the maritime sector was crucial in economic growth and job creation, global trends showed increased maturity in investment decisions that considered environmental priorities. According to Bergqvist and Monios (2019:1-17) there must be increasing focus on decarbonisation of the marine sector by Ports Authorities. While infrastructure investment and capacity building were constrained by budgets, there must be an urgent drive to embrace the green port systems with respect to port policy and environmental regulations when investments were being considered. Bergqvist and Monios (2019:1-17) advocated that all infrastructure investments must be mindful of climate change mitigations even if this

impacts the financial viability of the investment. The focus areas within the green ports spectrum was in noise, dust, waste and water pollution. These factors must be considered as sustainability and environmental prerogatives by ports in investment decision making. The project selection criteria therefore includes capacity creation to maintain adequate, reliable, sustainable port infrastructure. Capacity creation could be achieved through increasing capacity in fleet and infrastructure, leveraging market growth opportunities and promoting optimized land use.

2.3.3 To determine whether project selection and prioritization improves investment decision making

This objective explored investment decision making in state-owned entities and compared the prerogative at South African ports to other international ports. The study conducted a contextual comparison of the latest accredited academic journals, articles and books to identify the strategic objectives of the Ports Authority with respect to capital investment in infrastructure. The study explored the international, national and port related drivers for economic growth required for the Ports Authority to achieve strategic alignment.

2.3.3.1 Impact of infrastructure development on the South African economy

The best projects were the projects that created the most value (Rose, 2013:3) (Singh, 2019:1-6). Organizations were therefore challenged to measure project value both to the shareholder as well as the stakeholder. Unlike the private sector, state-owned companies cannot assume that maximizing profit maximizes project value. An article by Sepehri (2013:1-10) states that companies that evaluate projects by estimating impacts on cash flows and financial metrics alone ignored a significant component of the value derived from the project. Further, the Ports Authority was at risk of losing market share since other countries on the African continent had latched onto the concept of capacity creation, and had plans in place to develop new capacity within the freight logistics industry. Ikome, Lisinge, and Tama (2016:255) confirmed through research that the South African economy had entered recession and projected lower-than-expected growth with every passing year. This placed a strain on the fiscal framework of the country and more so on South Africa's largest state-owned entity, the Ports Authority. Southern African ports face increasing pressure to increase port capacity and alleviate problems with congestion, service quality and port performance as evidenced by Acciaro (2013: 207). According to Fraser (2016:1-2), port objectives in South African ports were not reflective of the tariffs charged since South Africa did not have a clearly defined port doctrine. According to Ndlozi (2016:1-87), South Africa was challenged by its exorbitant port tariffs and increasing foreign debt used to fund port infrastructure. Njue, Kyalo, Mulwa and Mbugua (2016) stated that the majority of the infrastructure development projects, within parastatals in South Africa, were driven by an urgent need and pressure to deliver returns on investment and not by opportunities for growth and expansion. Generally, beneficiaries were cautious to invest in assets or infrastructure with poor return on investment so interest rates increased to attract investors. An increased interest rate affected the affordability ratios and return on investment of capital projects. The research cited above did not elaborate on how the Ports Authority should position itself to stimulate economic growth in South Africa or on the critical success factors that should be prioritised to overcome the challenges in securing funding for infrastructure development. While the research cited above was congruent with the general theme that the Ports Authority would lose market share and investor funding if it continued with current trends of poor performance, non-delivery of infrastructure and exorbitant port tariffs, it was materially lacking in proposing a port doctrine or on recommending solutions to close the gaps and improve the Ports Authority's competitive positioning. Further, while the author's did state the challenges

experienced by the Ports Authority in developing competitive intelligence to secure investor confidence, there was no frame of reference in terms of how these challenges had been successfully overcome in similar state-owned entities in the marine sector. There was also limited best practice benchmarks to recommend improvement to challenges impacting the Ports Authority in terms of competitiveness, investor confidence, growth, transitioning for diversification and preference in the African and global context of world class logistic service providers. The literature seemed to suggest that successful project delivery depended on having the right people skills and levels of experience however there was no emphasis on choosing the right projects to begin with. The research above lacked in identifying the critical success factors for Transnet with reference to the Market Demand Strategy, Port Development framework plans or the Transnet 4.0 strategic thrust. Several scholars agreed that infrastructure investment in developing countries was pivotal to economic growth (Ikome, Nguendi and Tama, 2016:255-277) (Acciaro, 2013: 207) (Ndlozi, 2016:1-87). The literature review did not present with findings of a recommended framework for selecting projects in state-owned entities within South Africa.

2.3.3.2 Key challenges with project delivery in South Africa

i. Skills and experience

Nethathe, van Waveren, and Chan (2011:1-15) concluded through research conducted at the Transnet Freight Rail that most of the critical success factors, for multiple project success, falls under the category of people management. The research revealed that when employees were inexperienced, skill transfer became more crucial to ensure the quality of project outcomes. The two most important success factors were identified as selecting the project team with the right skills and competencies to deliver in the multi-project environment and secondly, commitment of the project team and stakeholders to the success of the project. The second success factor highlighted the importance of aligning projects with strategic objectives of the organization so that project teams shared common views of project commitments and deliverables. This finding suggested that the organization share a common vision regarding the prioritization of multiple projects. Wheeler (2013: 1-12) recommended through research that “projects and programmes that were selected to be undertaken should be consistent with strategic objectives for the organisation; should provide value for money and return on investment; should be adequately resourced and prioritised; should not compete with general operations for resources and not restrict the ability of operations to provide income to the organisation; should match the capacity and capability of the organisation to deliver; and should produce outputs that were willingly accepted by end users and customers”. A modified Delphi approach was applied through Wheeler’s study to investigate best practice and to determine the factors that contributed to optimal selection of projects, and the associated strategic level decision making. The findings identified the factors that contributed to the optimal selection of projects as: “culture, process, knowledge of the business, knowledge of the work, education, experience, governance, risk awareness, and time pressures” (Wheeler, 2013: 14). The study concluded that organisational culture and leadership were the key contributors to optimal selection of projects. Organisations must therefore consider the underlying drivers of organisation culture and leadership to optimise decision making on the billions of dollars they invest in projects each year. The reasoning behind this conclusion was further investigated in the context of projects at the Ports Authority.

ii. Strategic alignment

While the factors identified as critical to optimal project/ portfolio selection were considered generic to Transnet and recommended as good practice in the project environment in general, there were obvious requirements to consider specific drivers that contributed to project selection and decision making in state-owned entities such as the Ports Authority. These contributors to project selection could differ somewhat from private industry within South Africa, Africa and the rest of the world. Hence the study would have to identify the project selection criteria suitable for infrastructure investment in the Ports Authority, South Africa. While changing the Transnet culture and leadership styles would prove challenging, there were processes for project selection and execution that could be modified to make the infrastructure investment objective, robust and fail proof. In support, Njue, Kyalo, Mulwa and Mbugua (2016:1-13) concluded in their research article that projects implementation continued to face challenges not limited to cost overrun, scope creep, ineffective stakeholder participation and poor quality of project deliverables which contributed to customer dissatisfaction, unfulfilled project objectives and loss of investment opportunities. The authors recommended that project selection should be a systematic, objective process with an aim of producing prioritized project alternatives so as to facilitate informed decision making on the choice of the most viable projects to pursue. Hence this research would seek to identify project selection criteria before developing a project selection model to improve invest decision making in investment programmes at the Ports Authority.

iii. Competence of leadership

Research conducted by Mamman and Zakaria (2016: 246) criticized the principle of UBUNTU “respect for autonomy” within African organizational leaders as this over-reliance on people leadership detracted from the objectivity of business goals. It further created bottlenecks in the decision making process attributing to the delays and underspending of capital expenditure. Garg and Ramjee (2013) agreed with this premise in the article where he expanded on leadership theory to prove that leadership was critical to the success or failure of an organisation. The transactional, UBUNTU style leader garnered employee commitment towards the leader instead of commitment towards the organisational goals. In the research paper by Mbele (2015) agency theory was used to conclude that while it was oftentimes the case that managers were driven by “selfish financial and material gains”, there was evidence to suggest that for those managers (agents) committed to the performance of the company, legislation and regulations enabled managers to flourish. Mbele concluded in his research that SOE’s were overwrought with corporate governance drivers in the form of multiple legislations, and stringent reporting and accountability requirements at the expense of company performance. The over-zealous controls in the legislative and regulatory environment lead to an unhealthy organisation where Boards and Management were “unsure of taking decisions which ordinarily resided in their sphere of competence” (Mbele, 2015: 70). Their fear of reprisal crippled their abilities to perform and deliver on organisational objectives. In the OECD publication of SOE Governance Guidelines for Southern Africa (2014:1-33), the OECD recommended performance evaluations for board members within SOEs for the continuous monitoring and controlling of SOE performance. The OECD also recommended that the government should not be involved in day-to-day management within SOEs but rather allow the board autonomy to achieve defined objectives independently, and instead focus its efforts on establishing procedures to monitor SOE performance. These studies reflected leadership challenges common within the

African culture and thereby indicated that changes in leadership would affect employee commitment and overall business success in project teams within the Ports Authority. Furthermore, there appeared to be no structured decision making techniques employed within the Ports Authority. The all-too-common strategy was to out the problem, doing nothing until a solution materialized out of imminent business risk or a solution was somehow chosen through adverse circumstances. The authors used leadership theory to demonstrate how none of the abovementioned approaches were very effective. The organization needed a systematic, objective, organized way to evaluate choices and select the option that offered the best solution to the problem. The deduction from the research reviewed demonstrated the need for objective, measureable, repeatable project selection criteria aligned with industry best practice to reduce the reliance on autonomous decision making, bureaucratic delays and cultural barriers with respect to project selection and prioritisation within African countries.

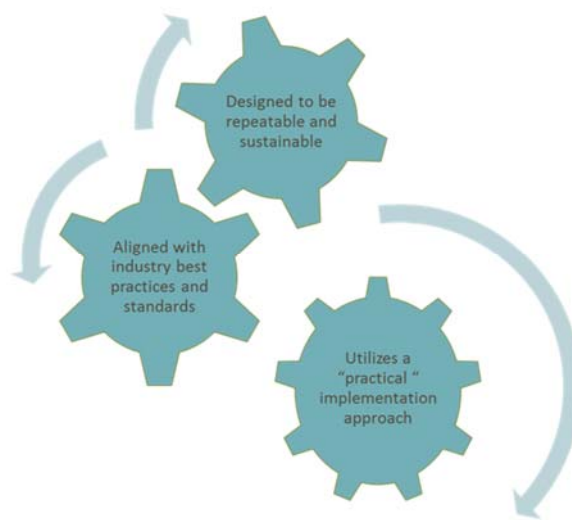


Figure 2.6 - Good practice for practical implementation of a project selection model [Source: PMBOK® Guide – Sixth Edition (2017)]

The research conducted by Mpofu (2016:1-21) further concluded that projects that were executed outside strategic business objectives were essentially non-viable. This study aims to show that projects can be selected for inter-relationships, interdependencies and support of business objectives and remain viable even if they do not contribute directly to the business bottom line. Any expenditure that was fruitlessly and wastefully employed was deemed a PFMA violation as per Public Finance Management Act No 1 of 1999 Government Gazette 40637 dated 24 February, 2017. Hence, the challenge was to develop clear performance metrics and project selection criteria aligned with business objectives while using the PMBOK recommended good practice for implementing a project selection model (Figure 2.6) within the Ports Authority. Further, Mpofu (2016:1-21) purported that parastatals had rigid organizational structures, lengthy bureaucratic approval processes and an over-reliance on the PMBOK methodology for executing and measuring project performance. This research investigated such claims with the view that while the project methodology within the Ports Authority was guided by the PMBOK (2013), it was largely based on the principles of project lifecycle management designed for front end loading to alleviate failure in project execution. The analysis of the results gained from this research examined Mpofu's research conclusions

with respect to the lengthy bureaucratic decision making style that inevitably results in delays in a rigid hierarchical state-owned enterprise structure such as that of the Ports Authority.

iv. Governance and ethics

The subject of ethics and corporate governance had been featured on many platforms owing to the dubious behaviour of public domains in the past decade. For South Africa, the King Commission on Corporate Governance (2010) was developed and subsequently modified for State-owned Enterprises (SOEs) and had to some extent improved corporate governance in South Africa since 1994. Many issues of concern remained with respect to corporate culture in the context of South African capitalism. Findings from the online article by Mpinganjira and Roberts-Lombard (2015), reflected that state owned companies in particular had been slow to adjust to the merits of governance and ethics in fast tracking decisions to actualize robust corporate governance practices with the aim of delivering shareholder value. The most prevalent mechanism to control ethical conduct in SOEs was found to be ethical audits and training of staff. According to Mbele (2015), the environment within SOEs remained in distress as boards and management struggled to maintain a balance between legislative compliance and performance. The chief purpose of a governed business environment was to provide a structured approach by which the leadership and management could be directed, controlled and held to account. Governance within the Ports Authority serves as an enabler in aligning strategy and leadership decisions to contribute to the Ports Authority's and South Africa's development objectives through delivering what was promised within the correct timelines, cost commitments and realised business benefits (Transnet Sustainability Report, 2018). Governance fosters an environment and culture of transparency and accountability for the decisions made with proper line of sight to support effective decision making and risk management. It also guides and enables efficiency and effectiveness of delivery through the use of applicable policies and best practice methodologies, processes, and systems. The role of governance within the Ports Authority was to implement and embed the applicable SOE capital policies; methodologies and standard operating procedures within the Ports Authority. The key objective was to ensure accountability; transparency; auditability; risk reduction and compliance by ensuring that capital management & delivery was executed in line with the Project Lifecycle Process (PLP).

2.4 Conceptual framework

A conceptual framework was developed for the study to show how each study variable would be measured. According to Kothari (2004: 19) the dependent variable varies in relation to the independent variable. Business success in the context of project selection and prioritization at the Ports Authority relies on the quality and effectiveness of the investment decisions. The investment decisions in turn depend on the project selection criteria and the project selection model in guiding a viable infrastructure investment programme. Kothari (2004: 14) stated that the independent variable was related by statistical variation to the dependent variable. A change in the independent variable causes a variation in the dependent variable hence there may be a causal relationship between the independent and dependent variables in the study. In this study, the independent variables were identified as the project selection criteria and project selection model.

2.4.1.1 Investment Decisions

The theory of constraints, as introduced by Israeli physicist Dr. Moshe Eliyahu Goldratt was first published 1984 offered a comprehensive approach to identifying the constraints in the process of project selection and prioritization and progressively eliminating constraints in the journey towards continual improvement (Şimşita, Günayb and Vayvayc, 2014:1-7). An article by Njue, Kyalo, Mulwa and Mbugua (2016:1-13) presented a conceptual framework to examine the interaction between organizational strategic thinking and the relationship between project selection and portfolio implementation using the Pareto analysis. Both of these theories were successfully applied and implemented in a range of similar marine sector industries and could be implemented in the Ports Authority as well (Rose, 2013:3) (Singh, 2019:1-6). Transnet had adopted the lean and six sigma approach to problem solving and had widely implemented this approach on all continuous improvement projects within Transnet. The lean six sigma process was versatile in its application and could be universally applied in all Transnet operating divisions and all departments within the operating divisions. This approach has been successfully applied on operational, maintenance and capital project platforms for improving customer service, solving problems and implementing solutions effectively and efficiently within the Ports Authority. The introduction of Six Sigma could be traced back to its successful implementation in Motorola in 1986 where preference was given to Lean Six Sigma over more popular models of the time such as Kaizen and Total Quality Management (Singh, 2019:1-6). According to Singh, Lean traditionally focuses on the elimination of waste in its basic process flow. Six Sigma seeks to improve the quality of process outputs by identifying and removing the causes of defects (errors) and minimizing variability in (manufacturing and business) processes. Lean Six Sigma comprises of all the Lean and Six Sigma tools for waste elimination and reduction in defects by implementation of the DMAIC (define, measure, analyse, improve, control) model (Singh, 2019:1-6). Lean Six Sigma was generally easy to apply in the operational and production environments to identify causes of defects and errors in the system. Alexandra and Pinto (2014: 1-10) successfully implemented a Lean Six Sigma (LSS) project management process improvement model in a real projectized organisation which had formal and established project management systems based on the PMBOK and the best practice standards for project management according to the Project Management Institute (PMI).

As shown in figure 2.7, the Construction Industry Institute (CII) recommended lean implementation at the project level, to the extent possible, as follows: “(1) Select suppliers who were willing to adopt lean project delivery; (2) Structure the project organization to allow money to move in pursuit of the best project-level returns; (3) Define and align project scope, budget, and schedule; (4) Explore adaptation and development of methods; (5) Make design decisions, with explicit alternatives against stated criteria; (5) Practice production control in accordance with lean principles; (6) Build quality and safety into projects; (7) Implement Just in time (JIT) and multi-organizational processes after site demand; (8) Use evaluations and planning on process that transform materials; (9) Use computer modelling to integrate product and process design; (10) Use 5S workshops: a tool for workplace organization and promoting teamwork (S1) Sort through items, keep what was needed and dispose of what was not; (S2) Straighten: organize and label everything; (S3) Shine: clean; which can also expose abnormal and pre-failure conditions; (S4) Standardize: develop rules to maintain the first three S’s; and (S5) Sustain: manage to maintain a stabilized workplace and initiate continuous improvement when needed and (11) Apply Value Stream Mapping to make visible all the steps in process” (Gür, Hamurcu and Eren, 2016: 1-9).

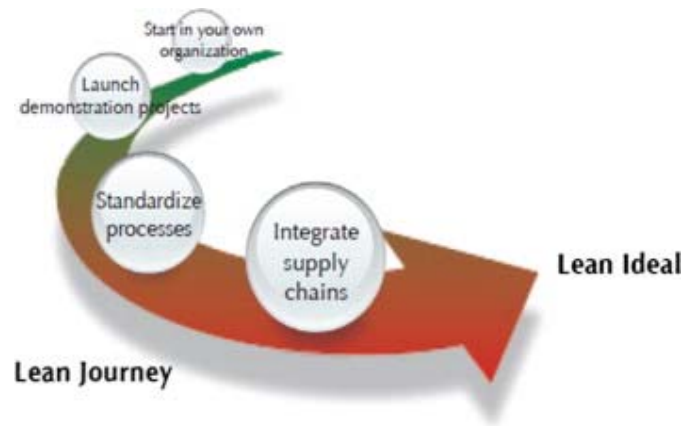


Figure 2.7: Lean journey to implement lean ideal [Construction Industry Institute]

Since Transnet had actively adopted the Lean Six Sigma approach to continuous improvement in business practices, the DMAIC model was applied in context of capital expenditure on infrastructure development at the Ports Authority, Port of Durban to identify the root cause for under expenditure in capital investments (Figure 2.8).

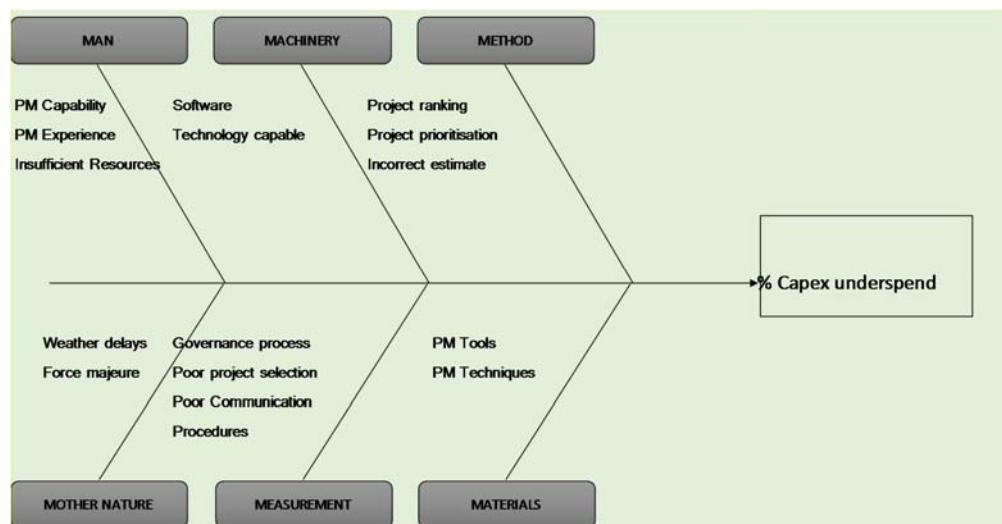


Figure 2.8: Inputs Identification using the Fishbone Diagram

Through critical application of the Lean Six Sigma DMAIC cycle-based approach at the ports Authority, Port of Durban, the results in figure 2.8 demonstrated that poor project selection contributed to CAPEX underspend on infrastructure development and thereby resulted in an erosion in investor confidence. Other root causes that contributed to poor project selection were listed in Table 2.3.

Table 2.3: Root cause identification through Six Sigma plan for Analyse

#	Likely Cause	Type of Input	Graphical Technique	Process Technique	Confirmed Root Cause
1	Project Deferral	Discrete	n/a	n/a	Yes

2	Governance Process	Discrete	n/a	n/a	Yes
3	Procurement Delays	Discrete	Pie Chart	n/a	Yes
4	Incorrect Estimate	Discrete	Bar Graph	n/a	Yes
5	Project Selection	Discrete	Bar Graph	n/a	Yes
6	Project Ranking	Discrete	Pie Chart	n/a	Yes

Hence, the framework for Lean Six Sigma was used to prove that project selection, project ranking and project deferral were contributors to poor infrastructure investment decisions within the Ports Authority. The study analysed the data collected between May 2018 and May 2019 to identify the root causes of capital underspend by using the Six Sigma methodology. These factors were analysed later in the study to support identification of the project selection criteria and interpretation of findings.

Table 2.4: Data Collection plan for problem identification

No.	Measure	Type of measure	Type of data	Operational definition	Sampling frequency	when	Who
1	Project Deferral	input	discrete	Projects budgeted on corporate plan but deferred to the next financial year	annually	30 May 2018	project sponsor
2	Governance Process	input	discrete	Governance Approval in first attempt	monthly	30 May 2018	project planner
3	Procurement delays	input	discrete	project was sanctioned but not contracted	monthly	30 May 2018	project manager
4	Incorrect Estimate	input	continuous	variance between project budgets and actuals between - 10% and 10%	monthly	30 May 2018	project controls
5	project selection	input	discrete	projects selected on corporate plan then deferred or cancelled	monthly	30 May 2018	EPMO
6	project ranking	input	continuous	projects ranked as a priority were not executed	monthly	30 May 2018	EPMO

2.4.1.2 Project selection model

The empirical literature review interrogated decision models that examined different criteria used in making decisions regarding project selection. Shukla, Mishra, Jain and Yadav (2016:120) suggested that Promethee was the preferred project selection method and eliminated fuzzy logic in decision making. Most industries basically applied two project selection methods. Calculation methods provided a way to calculate the value of the project, which was then used in project selection decision-making. Constrained optimization used mathematical models to analyse and compare projects for suitability while the more commonly applied method was the benefits measurements method (Morton, Keisler and Salo (2016:1-43), (Mohagheghi, Mousavi and Vahdani: 2016:1-28). Benefits measurement employed the techniques of net present value, internal rate of return and payback period to analyse and select projects. The literature reviewed for multi criteria decision making in project prioritization recommended that the MCDM analysis be used in a stepped approach tailor made for the selection, prioritization

and optimization of the organisation's investment decisions. Mohagheghi, Mousavi, Aghamohagheghi, and Vahdani (2017:1-22) recommended a fuzzy form of AHP for project selection modelling in the transport industry where the emphasis was the sustainability of the decision making criteria. They advised that while earlier models focused on the financial criteria of projects, there had been increasing focus on looking at the strategic alignment, risk profiles, regulatory compliance and organizational readiness in addition to addressing the strategic financial criteria in projects competing for funding sources. Project selection models used across the globe vary depending on the critical success factors and demographic conditions of the business units involved in the multiple projects. While most MCDM methods were employed successfully in private industry as evidenced by Wheeler's article, the research recommended the Analytical Hierarchical Process (AHP) for project selection in SOEs as it appeared to be more integrative and able to accommodate strategic objectives of government, objective enough to guide the inefficiencies in decision making while still being adaptable to stringent governance processes and procedural delays particularly with financial management and procurement. A study by Nethathe, van Waveren and Chan (2016) focused on contributors to project failure in parastatals within developing countries such as South Africa. The results showed that the biggest deterrent to project success in parastatals was the size of the business unit as well as the employee's project experience. Hence it was important that the project selection model was user – friendly and simple to understand. Using these studies as a guide, the study opted to define the criteria for project selection and prioritization as recommended by the AHP method. The AHP was the preferred approach for project selection and this study used the AHP theoretical framework in the assessment of priority scales using the project selection criteria. The priority scales recommended through the AHP method closed the gaps for selecting, prioritising and validating project selection and prioritization with the Ports Authority. Benaija and Kjiri (2015: 1-11) emphasized that the key to success in project selection and portfolio management was to use an interactive approach, through the intervention of decision makers, to define the selection criteria, maximize the organization's value; balance the portfolio (in order to minimize the risk) and finally to adjust the portfolio to align with the organization's strategy (strategic alignment). As recommended by Velasquez and Hester (2013:1-11), the project selection criteria was used to devise priority scales and this allowed contextual fit into the organisation. Butcher and Schutt (2016: 1-19) recommended validating the priority scales. This study therefore used a mixed method research approach where qualitative interviews and analysis were adopted to identify the project selection criteria as key contributors to decision making specific to the Ports Authority environment and thereafter to robustly test the outcomes of the research and model development through the second round of research using quantitative surveys and analysis.

2.4.1.3 Earned value management

Research conducted by Ngcobo (2016:1-86) expounds on the importance of monitoring and evaluation of project performance using the Earned Value Management (EVM) technique. According to Ngcobo, most SOEs were not currently set up efficiently for Earned Value Management. This situation was not unique to projects managed at the Port of Durban. The requirement from stakeholders was that every project should have at least 2 EVM indices (table 2.5) to indicate performance management e.g. cost performance index (CPI) and schedule performance index (SPI). To be compliant with these reporting indices, the Ports Authority would require a model that measures project performance based on business case objectives e.g. cost variance, schedule variance, estimate at completion. Investment analysis prioritizes projects on the profitability scale in terms of the requisites of the Public Finance Management Act No 1 of 1999 Government Gazette 40637(2017) of the National Treasury in

South Africa. This study investigated the merits of incorporating the EVM indices into the project selection model so that projects could be monitored during execution and reviewed post implementation to gauge the true cost benefit of the investment decision. The study also investigated the capital budgeting techniques to weight and rank financial metrics.

Table 2.5 – The interpretation of EVM indices

Reading	CPI	SPI
Greater than 1	You are earning more (value) than the spending. In other words, you are under budget.	More work has been completed than the planned work. In other words, you are ahead of schedule
Less Than 1	You are earning less (value) than the spending. In other words, you're over budget	Less work has been completed than the planned work. In other words, you are behind schedule.
Equal to 1	Means earning and spending are equal. You can say that you are proceeding exactly as per the planned budget spending	All work is completed / On track

2.4.1.4 Port tariff methodology

On 1 August 2018, the Ports Authority applied to the Ports Regulator for approval of the tariffs for services and facilities offered by the port system. The application requested approval of an average tariff increase of 4.21% for the 2019/20 tariff year together with indicative tariffs for the periods 1 April 2020 to 31 March 2021 and 1 April 2021 to 31 March 2022. On 30 November 2018, the Ports Regulator published its Record of Decision and concluded an overall adjustment in average tariffs for FY 2019/ 2020 was a decrease of 6.27%. According to the Ports Regulator of South Africa's Record of Decision (ROD) on the Ports Authority's tariff application for FY 2019/ 20 to 2021/22, the increasing lack of government funding has led to ports becoming less competitive (Fakir, 2018: 1-58). A further challenge in the governance of port pricing and competitiveness resulted in the Ports Regulator South Africa (PRSA) declaring the Port of Durban as one of the priciest ports in the world. Figure 2.9 illustrates the governance framework in South Africa and the relationship between the PRSA and the Ports Authority. The tariff decrease determined by the Ports Regulator was largely explained by its decision to apply a new valuation approach to the Ports Authority's regulatory asset base. In efforts to factor in the outcome if this decision by the PRSA, the Ports Authority was challenged to reconcile the economic impacts of developing infrastructure against the recovery of investment costs.

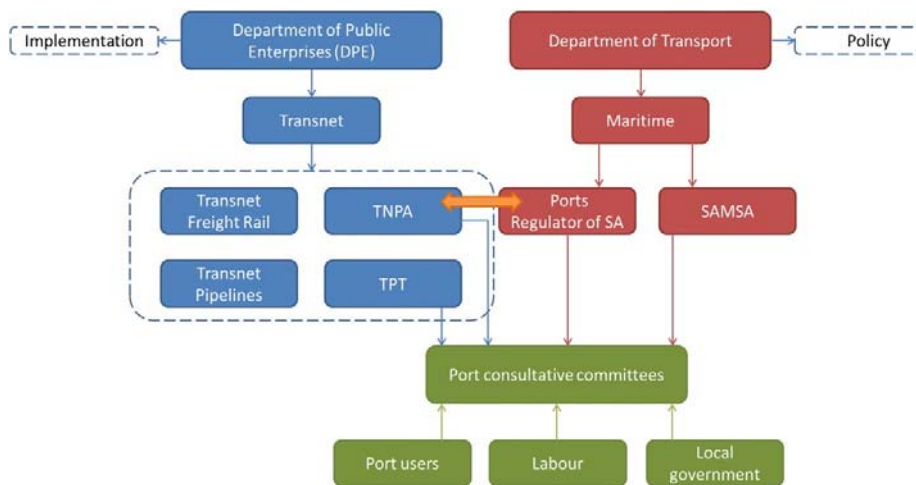


Figure 2.9: The governance framework for South African Ports (PRSA – 2018)

The key functions of the Ports Regulator was “economic regulation of national ports in order to achieve government strategic objectives, promotion of equity, access to the national ports and to monitor the port authority in order to ensure compliance with the National Ports Act, 12 of 2005 (the Act)” (Government Gazette, 2005 p.68). The PRSA ensures that Ports Authority recovers its capital spent on investments; recover its costs of operations and attains a sufficient return to cover the opportunity of the capital employed in the production of its services. Table 2.6 indicates the application of the Ports Authority service charges for services rendered. The implications for tariff reductions were far reaching as the tariff was the primary source of the income for the Ports Authority (Transnet, 2018) and was used in part to sustain and develop infrastructure so that the port responds to customers’ demands and remains globally competitive. The PRSA had concerns that the tariff application was to be better articulated and tied to demand and traffic forecasts as articulated in paragraph 5.1.2 and in line with Directive 22(3) (b) of the tariff manual where applicable (Fakir, 2018: 1-58). The past applications by the Ports Authority provided high level generic information that oftentimes did not materialise resulting in the customers paying for the promise of services and infrastructure that was not provided. As part of the PRSA request for more detailed articulation of the 7 year CAPEX projects and transparency tied to demands and traffic volumes, the Ports Authority was required to provide a three year business case pipeline with complete approved business cases as a guaranteed forward load of the infrastructure plans for development with capital commitment. The PRSA would also monitor, among other factors, the manner in which the tariff was calculated with respect to the Ports Authority’s regulated asset base as this informs the CAPEX component of the tariff calculation. The PRSA was of the opinion that the Ports Authority needs to revisit the debt structure and the cash management of debt.

In the research conducted by Meyiwa and Chasomeris (2016: 1-20) the reasons cited for the inconsistencies in tariff structures leaned towards the lack of a defined port doctrine. This lead to conflicting objectives in South Africa’s ports where prices charged to customers were not indicative of the true costs incurred for different services. The ports had struggled to justify the revenues and costs allocated to various commodity types. Cross subsidizations had become the red herring obscuring cost justification and over charges. Meyiwa and Chasomeris recommended short, medium and long term adjustments to the port tariff methodology to address stakeholder dissatisfaction. The PRSA had adopted some of the recommendations in the recent changes to the port tariff methodology, however the effectiveness of justifying port costs remained subject to speculation. Meyiwa and

Chasomeris (2016: 1-20) suggested that Asian port doctrine be adopted in the medium term to assist the Ports Authority in complying with the National Ports Act, act number 12 of 2005. The Regulator was tasked with setting basic directions in the methodology that prevented congestion and simplified port tariffs. Infrastructure development should ensure integrated supply chain development, balance demand and supply of infrastructure in South African ports and be cost effective maintaining the view that “the ports infrastructure belongs to the nation and must be managed to serve the welfare of the nation without generating huge profit out of its operations” (Fakir, 2018: 1-58).

With respect to the tenets of aligning project selection to business strategy, Nonino (2017: 245-263) conducted a study to show that a balanced portfolio was more likely to deliver on the strategic objectives of the company. According to Nonino, projects vary significantly, and each programme should be geared towards accomplishing unique but specific deliverables. Projects should be categorized ensuring that projects with similar traits were grouped under one programme. Similarly, programmes with interdependencies should be grouped together under the same portfolios. According to Korotin Popov, Tolokonsky, Islamov, and Ulchenkov (2017) as well as Mohagheghi, Mousavi, Aghamohagheghi and Vahdani (2017), categorizing projects assist in balancing portfolios. It also facilitates a simplified format for managing, controlling and measurement of deliverables for ease of stakeholder reporting. Hence in this study, the prioritization and ranking of projects would give clear focus on the business critical or strategic projects to invest in or to defer during economic crises.

2.5 Research gap

This study delineated the research gap based on the empirical literature reviews.

Several scholars agreed that infrastructure investment in developing countries was pivotal to economic growth (Ikome, Nguendi and Tama, 2016:255-277) (Acciaro, 2013: 207) (Ndlozi, 2016:1-87). Njue, Kyalo, Mulwa and Mbugua (2016) stated that the majority of the infrastructure development projects, within parastatals in South Africa, were driven by an urgent need and pressure to deliver returns on investment and not by opportunities for growth and expansion. The Ports Regulator South Africa contended that the Ports Authority was not creating new infrastructure assets to stimulate the economy and accommodate new vessel demands (Fakir, 2018: 1-58) (Havenga, Simpson and Goedhals-Gerber, 2017: 1-13). The literature suggested that the Ports Authority would lose market share and investor funding if it continued with current trends of poor performance, non-delivery of infrastructure and exorbitant port tariffs. The literature review did not present a recommended best practice framework for selecting projects in state-owned entities within South Africa to alleviate the challenges discussed.

The process of project selection and prioritization as guided by the PLP methodology at the Ports Authority was viewed as subjective as it placed a lot of accountability for project selection and prioritization in the hands of the project sponsor. The OECD (2014:1-33) emphasised the opportunity for bias and corruption when infrastructure investment decisions were made in this manner. The OECD (2014:1-33) also mentioned the irregular practices such as conflicts of interest and outright corruption that had been evident without an objective project screening and selection framework.

Table 2.6: Port Service Charges [Source: Transnet Integrated Report, 2017]

	Service Rendered	Application/ Charging Unit
Light dues	The provision of navigation aids to vessels along the South African coast	Raised per vessel (per gross ton) at the first port of call
Vessel Traffic Services	The provision of vessel traffic services, safety of the port environment and port control	Raised per vessel (per gross ton) at all ports
Port dues	The provision and maintenance of entrance channels, breakwaters, turning basins, navigational aids (beacons and buoys inside port limits) and maintenance dredging inside the port	Raised per vessel (per gross ton), linked to the time that the vessel remains in port
Berth dues	The provision and maintenance of repair quays and other non-cargo quay (berth) infrastructure	Raised per vessel (per gross ton), per 24-hour period
Cargo dues	To recover the cargo contribution towards the provision and maintenance of basic port infrastructure	Raised per unit of cargo, differentiated between different commodities
Pilotage	Pilotage assistance to vessels entering/leaving the port	Raised as a basic fee per service, plus per vessel (per gross ton)
Tug Assistance	Tug assistance to vessels entering/leaving the port	Raised per service, based on the size of the vessel (per gross ton)
Miscellaneous Tug/Vessel services	Tanker fire watch, firefighting and standby services	Raised per service, per hour
Berthing Services	Berthing services to tie/untie vessels at the berth	Raised per service
Running of Vessel Lines	Running of lines for vessels entering, leaving or shifting	Raised per service
Floating Crane Services	Floating crane services rendered to the vessels	Raised per service, per hour
Ship Repair Facilities	Preparation, Docking and Undocking of vessels at repair facilities	Raised per service
Dry-dock, floating dock, synchrolift and slipways	Dry-dock, floating dock and synchrolift fees	Raised per service for the use of a facility, based on the size of the vessel (per gross ton)

Source: Transnet National Ports Authority

Gate reviews were expected to ultimately contribute to a healthy investment portfolio and good practice for project delivery of capital projects across the Ports Authority. The fundamental drawback of the gate review process was that it did not interrogate the strategic alignment of the project or the process for project selection and prioritization as recommended by Cheshmberah, Makui, Seyedhoseini, and Yousefi (2011:216-226). The gate review panel only interrogated the project documentation for quality assurance in complying with the PLP methodology. Hence a project that was incorrectly selected and prioritized for capital investment would receive capital investment at the expense of a more deserving project as long as the project documentation met the quality assurance criteria of the gate review panel.

While the PLP methodology encouraged strategic alignment with the business objectives, the project selection tool was the corporate plan and had no requirement for strategic alignment of projects with business objectives. A deep dive into the portfolio analytics on the corporate plan as a project selection and prioritization tool, revealed the recurring issue that while the Ports Authority was intending to manage portfolios through the corporate plan, the fundamental requirement of selection and prioritization of projects were not addressed and the corporate plan was currently being used as a financial tool to forecast cash flows in each financial year and measure the projects progress to the planned budget (Yang and Notteboom, 2017:1-17). By PMBOK definition, the corporate plan should be the output of a portfolio selection plan to select, prioritize and rank projects of strategic importance to the business (PMBOK Guide, 2004). An article by Sepehri (2013:1-10) stated that companies that evaluated projects by estimating impacts on cash flows and financial metrics alone ignored a significant component of the value derived from the project. Hence basic portfolio theory needed to be adapted to improve investment decisions in the Ports Authority. A study by Silver (2019:1-7) showed that stakeholder requirements such as regulatory compliance, job creation, safety and health requirements, operational efficiencies and capacity creation was more encompassing than financial performance metrics. Silver also suggested that by merely looking at the financial indices, the organization was likely to invest in portfolios that did not improve organizational competitiveness, create a safe, compliant working environment or promote sustainability. Hence the project selection criteria should demonstrate strategic alignment with organizational objectives in order to improve business investment decisions (Silver, 2019:1-7). A selection model was a proven technique employed in a structured and objective approach to guide decision making in balancing the needs of the business with those of the customers and stakeholders (Gosenheimer, 2012:1-8).

The EPMO prepared and tried to implement a project ranking model of sorts. The ranking model ranked projects in order of importance to other projects, but not aligned to the strategic objectives of the organization. Hence maintenance projects could receive higher ranking scores than capital projects. Projects not justified by alignment with the business strategy could be prioritized for investment funding. The ranking model was also not aligned to business readiness dynamics. Hence a project could be prioritized for capital spending and then deferred because it was running behind schedule (Transnet, 2019). This practice was contrary to the recommendation of several authors including Mohagheghi, Mousavi and Vahdani (2016: 1-28), Njue, Kyalo, Mulwa and Mbugua (2016) as well as Cheshmberah, Makui, Seyedhoseini, and Yousefi (2011:216-226).

The authors recommended that project selection should be a systematic, objective process with an aim of producing prioritized project alternatives so as to facilitate informed decision making on the choice of the most viable projects to pursue. Hence this research would seek to identify project selection criteria before developing a project selection model to improve investment decision making in investment programmes at the Ports Authority. This study aims to show that projects can be selected for inter-relationships, interdependencies and support of business objectives and remain viable even if they do not contribute directly to the business bottom line. The AHP was recommended as the preferred approach for project selection and this study will use the AHP theoretical framework in the assessment of priority scales using the project selection criteria. The priority scales recommended through the AHP method will close the gaps for selecting, prioritising and validating project selection and prioritization with the Ports Authority.

2.6 Chapter Summary

This chapter reviewed the key challenges with project delivery at the Ports Authority as well as the contributors to project selection and prioritization by reviewing the port objectives against the port tariff methodology and aligning them to the prioritization of infrastructure in South African ports. There was review into the types of decision making that would contribute to project selection at the Ports Authority and a comparison of the recommended good practices to ensure objectivity and good governance. The research gap identified the weaknesses and strengths in the past empirical research with respect to the study objectives. The chapter also identified a methodological gap on the process for project selection and prioritization specific to the Ports Authority context by applying best practice recommendations from similar applications worldwide. In concluding this chapter, the study developed a conceptual framework for the current study and showed how the dependent and independent variables would be measured based on best practice theoretical frameworks for project selection modelling. The next chapter presents the research design and methodology.

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter outlines the research methodology that was followed in this study. The research methodology was mainly aimed at ascertaining whether project selection and prioritization had an impact on business success at the Ports Authority which is a state-owned entity in South Africa. Based on the empirical and theoretical gaps identified in the problem statement, the objective of this study was to develop a project selection model to support infrastructure investment programmes within the Ports Authority, South Africa. The sub- objectives of this study aimed to identify those quick win project selection criteria aligned to the Ports Authority's strategic objectives in order to select and prioritize projects for execution. To achieve this, this chapter aimed to benchmark the current practice against the best practice in relation to the selection, ranking and prioritization of projects in Transnet, a State-owned Entity; and also identify the key contributors in project selection and decision making within the Ports Authority.

This chapter discusses the research design, philosophy, methods, strategies, population and sampling techniques, data collection methods, data collection instruments, analysis of the mixed methods research through exploratory sequential design and culminated in the model development using the outcomes of the qualitative analysis. This chapter also discusses validity and reliability, limitations of the study as well as ethical considerations adopted through the research

3.2 Research design

According to Kothari (2004:1), research is about a "search for knowledge". Furthermore, Kothari (2004:1) defines research as the "scientific and systematic search for pertinent information on a specific topic". The purpose of research according to Kothari (2004:1) is to obtain solutions to problems using a systematic approach. According to Taylor (2005:3) there are similarities as well as differences in both research paradigms. Research intentions and the information derived from the studies differ vastly utilising the qualitative and quantitative design methods (Taylor, 2005:3). While quantitative methods are considered "objective and reliable" where it tests theories and can be generalized to a larger population, qualitative methods by comparison are "subjective" and generate valid data in capturing attitudes, emotions and feelings (Taylor, 2005:3). The quantitative research is conveyed as scores and procedures which produce numerical results. The quantitative design method emphasises the deductive principles and places emphasis on logic. However, not all data can be analysed using numerical data. According to Taylor (2005:4) narrative and descriptive research design can be successfully used as much as the numerical methods, hence the qualitative research design. Moreover, qualitative design has revealed that word in a form of verbal, narrative and descriptive can be effectively used as numerical data. According to Creswell and Clark (2017:6-28), mixed methods research can be effectively used as a methodology for conducting research to provide a more in-depth understanding of a problem rather than using one research method only. In mixed methods research, data is collected, analysed and integrated in a single study.

The recommended study design in this instance was a mixed methods research through exploratory sequential design where the qualitative data was collected first (Creswell and Clark, 2017:6-28). A research hypothesis was formulated from the problem statement and was consistently adopted throughout the qualitative and the quantitative phases of the research. The first phase of the study was a qualitative exploration of project selection criteria being used to select projects for capital investment and prioritization within each financial year at the Ports Authority. After analysis and interpretation of the qualitative data, the researcher used the recommended project selection criteria and the existing format of the corporate plan to align with recommendations from best practice and thereby developed a project selection model for capital investment in infrastructure programmes at the Ports Authority. The reason for collecting qualitative data initially was to formulate an understanding of the current practice for project selection based on the experience of experts within the Ports Authority and to benchmark the current practice to the guiding theory and best practice on project selection and prioritization. As a deductive outcome of the data analysis of the qualitative research, the researcher developed a customized project selection model for the Ports Authority. The second quantitative phase followed up on the qualitative phase for the purpose of testing the project selection criteria identified through data analysis of the qualitative research. The quantitative research also tested the effectiveness of the project selection model, in prioritizing an infrastructure capital investment programme, by using quantitative research techniques.

3.3 Research philosophy

A research philosophy is a view held by the researcher about the way in which data about a particular phenomenon should be collected, analysed and utilised. Two research philosophies have been acknowledged namely positivist (also known as scientific) and interpretivist (also referred to as anti-positivist) (Galliers, 1991:1-4). The view is further supported by Saunders, Lewis and Thornhill (2012:166) that quantitative research design is usually related to positivism and the qualitative research design is usually related to interpretive philosophy. For the qualitative design method undertaken in this study the interpretivist philosophy was relied upon. According to Saunders et al. (2012:168), it is interpretive because the researcher had to infer, in a subjective manner, the phenomenon under the study and make conclusions. Saunders et al. (2012:168) further discuss that the interpretivist philosophy is also known as naturalistic philosophy because a researcher needs to conduct the research in a “natural setting” which will allow for confidence, contribution from subjects providing data as well as a deep appreciation of the data. Frey, Botan and Kreps (2000: 3) asserted that the interpretive research is “the belief that the researcher, while trying to see the situation from the point of view of those studied, cannot escape his/her own view”. Furthermore, Frey et al. (2000:5) asserted that phenomenology is the certainty that the subject of research can be surveyed without any predetermined ideas or expectations, the researcher makes his/her own standards, values, and philosophies apparent and does not assume they are common. Morgan (2014:1-10) recommends the pragmatic research approach irrespective of whether the research uses qualitative, quantitative or mixed methods. The benefit of the pragmatic approach rests with its practicality in treating research as a “human experience that is based on the actions and beliefs of actual researchers”. Morgan (2014:1-10) demonstrated that philosophical pragmatism provides a useful system for understanding research in general. Pragmatism is also preferred as a philosophical system that uses a practical approach to research design. According to Morgan (2014:4), “post-positivists claim that the world exists apart from our understanding of it, while constructivists insist that the world is created by our conceptions of it”. Hence the pragmatist approach in mixed methods research does not seek to differentiate

between ontological and epistemological research philosophies but rather to adopt a constructivist approach of inquiry where the study intends to establish the status quo within the organisation based on the respondent's past experience and to construct a new framework based on the recommendations from the respondents based on their expert knowledge and contributions. A pragmatic research approach was undertaken for this study. Based on the work of John Dewey (2008: 172), pragmatism points to the importance of joining beliefs and actions in a process of inquiry as illustrated in figure 3.1.

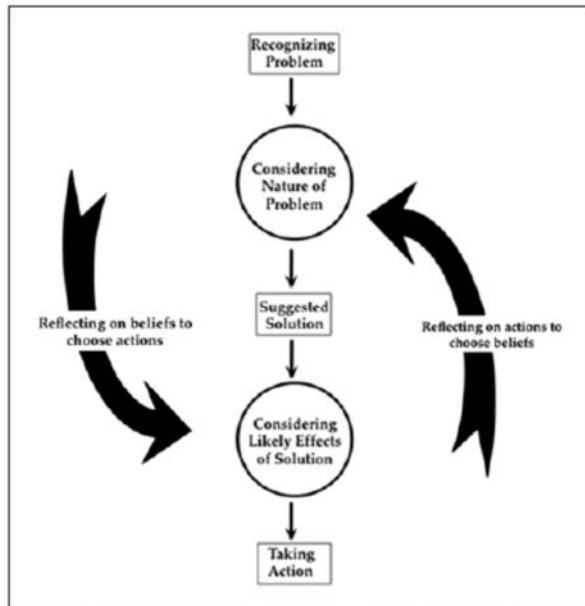


Figure 3.1: Dewey's Model of Inquiry [source: John Dewey, *Experience and Nature* (2008, p. 172)]

According to Dewey (2008: 172), mixed method research did not fit comfortably within the context of philosophical research hence most of the focus in mixed method research was on practical, procedural issues about how to combine the strengths of qualitative and quantitative methods rather than philosophical claims. Creswell and Clark (2017:67-72) recommends that the exploratory sequential design is a form of mixed methods research so it does have the pragmatist foundation philosophically, however the pragmatist foundation can be expanded to constructivism for the qualitative phase and shifts to post-positivism for the quantitative phase.

3.4 Research methods

According to Rajasekar, Philominathan and Chinnathambi (2013:2) research methods “are the various procedures, schemes and algorithms used in research”. All ways and means which are utilised in a study by a researcher are commonly known as research methods. Research methods assist in order to gather samples, data and ultimately formulate an answer to the problem. Furthermore, Rajasekar et al. (2013:2) indicated that research is divided into two comprehensive classes being fundamental or basic research as well as applied research. Basic and applied research can either be quantitative or qualitative. Research can also be a combination of qualitative and quantitative methods. Creswell and Clark (2017:1-4) describe mixed methods research as a combined longitudinal program where the quantitative component involves collecting, analysing, and integrating data where a person's actions can be controlled while their views and contributions are largely overlooked. On the other hand, qualitative research outlines the entire research and what needs to be deliberated upon in instances where there is no theory

on the research topic and variables are not known. Qualitative research has no designed process and highly depends on the researchers' analysis and resourcefulness to gather, infer and deduce the data. Hodgins (2017:106-376) therefore recommends that mixed methods research is highly advantageous to accommodate a higher likelihood of research comprehensiveness when using methodological triangulation as used in this study. When used in triangulation (i.e. validation and testing of consistency of findings obtained through different methods) the research is thorough and unequivocal. Mixed methods research (MMR) also lends itself to complementarity where the results from one method are used to clarify the use of the other method through triangulation. Hodgins (2017:106-376) also acknowledges that mixed method research facilitates using results of one method to shape the choice of method to be used in the next step of research. The research questions can also be interrogated by developing new research questions or challenging results obtained through the use of one method. Mixed method research is more expansive than other popular methods of research as it enriches the quality of the study by exploring specific features of each research method used. In selecting the suitable research method to follow, the researcher considered a comparison of the following types of research to suitably satisfy the research objectives of this study as discussed by Manzoor (2016:1-4), Hodgins (2017:106-376) and Creswell and Clark (2017:67-72).

- I. Mixed-methods research (MMR) combines methods, paradigms, and the approaches of qualitative and quantitative research as shown in table 3.1 whereby triangulation of methods enables a broader and more comprehensive picture to emerge about the research. A mixed methods approach involves the collection or analysis of both quantitative and/or qualitative data in a single study either concurrently or sequentially. Each type of data is given a priority level and integrated at one or more stages in the research process.
- II. Action research uses a cyclical process where the research, implementation, evaluation and theorising are linked to reduce the theory–practice gap. It is useful in addressing problems of practical concern as it is action focused and context specific.
- III. Delphi studies seek to gain expert consensus when there is little empirical evidence. These studies typically combine qualitative and quantitative data from a series of questionnaire phases.
- IV. A case study approach combines interview (qualitative) data to form statements about the topic of interest, which are then rank-ordered to produce quantitative data.

In their article, Whitehead and Schneider (2016:1-10) compares mixed method research to action research, Delphi technique and case study. Some of the reasons to select MMR over other research methods is that “method combination can provide confirmation of the results of each individual method” (Whitehead and Schneider, 2016:6). This is shown in table 3.1 for methodological triangulation through MMR that increases the data validity. Secondly, combination of methods can provide a richer data set by reducing methodological dominance of one research approach over another. Thirdly, method combinations can result in methods of thinking by analysing the contradictions that emerge from the two data sources.

Table 3.1: Simultaneous and Consequential combinations of Quantitative and Qualitative mixed method approaches [Source: Dean Whitehead (2016)]

Simultaneous and sequential combinations of quantitative and qualitative mixed methods approaches		
COMBINATION	RATIONALE	EXAMPLE
Simultaneous		
Qualitative + quantitative	There is a qualitative foundation and quantitative methods are used to provide complementary information.	The research is focused on the experiences of feeling depressed after miscarriage. Phenomenological methods could be used to address the question, and use of a depression scale would provide complementary information.
Quantitative + qualitative	There is a quantitative foundation and qualitative methods are used to provide complementary information.	The research is testing hypotheses about depression after miscarriage. The phenomenological method is used to uncover the experience for a select group who acknowledge feelings of depression.
Sequential		
Qualitative — quantitative	Findings from qualitative investigation lead to use of the quantitative approach.	The research has described the experience of feeling depressed after miscarriage. The themes emerging from the data are then used to create a depression scale, which is tested for reliability and validity.
Quantitative — qualitative	Findings from quantitative investigation lead to use of the qualitative approach.	The research has tested hypotheses linking miscarriage with depression and found no significant relationships. A qualitative study is undertaken to uncover the experience of living through miscarriage, in an effort to let the data lead to common thoughts and feelings.

(Modified from Morse J M 1991 Approaches to qualitative-quantitative methodological triangulation. Nurse Researcher 40:120-3.)

The Exploratory Sequential Design illustrated in Figure 3.2 is ideally suited to the research method intended. This method of research is intended to use qualitative data from the first phase of the research to determine variables and questions that inform the quantitative data collection in the second phase of the research. The qualitative data is therefore prioritized over the quantitative data. Creswell and Clark (2017:67-72) recommend to gather qualitative data from a small group of respondents and then to follow up with quantitative data collection from a larger group of respondents. This Exploratory Sequential Design allows the researcher to explore and understand a problem thoroughly before identifying project selection criteria to include in the model development.

Qualitative exploration leading to quantitative test

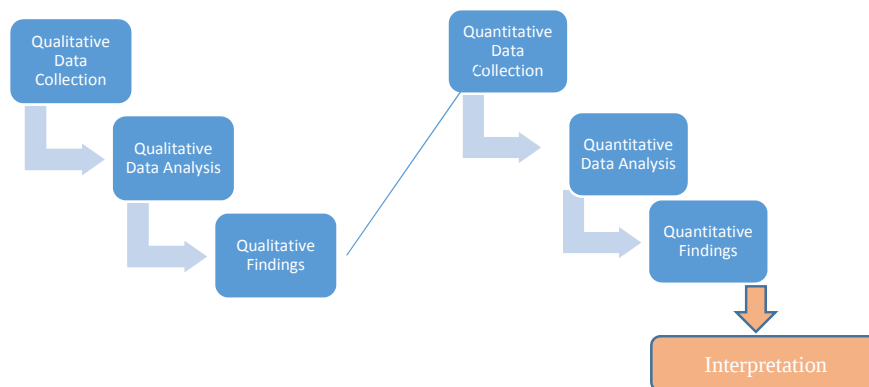


Figure 3.2: the basic mixed method Exploratory Sequential Design, [Creswell and Clark (2017:67-72)]

3.5 Research strategies

This study focused on the impact of project selection and prioritization on business success at the Ports Authority which is a State-owned Entity in South Africa. The recommended study design was a mixed methods research through exploratory sequential design where the qualitative data was collected first (Creswell and Clark, 2017:6-28). A research hypothesis was formulated from the problem statement and was consistently adopted throughout the qualitative and the quantitative phases of the research. The first phase of the study was a qualitative exploration

of project selection criteria being used to select projects for capital investment and prioritization within each financial year at the Ports Authority. After analysis and interpretation of the qualitative data, the researcher used the recommended project selection criteria and the existing format of the corporate plan to align with recommendations from best practice and thereby developed a project selection model for capital investment in infrastructure programmes at the Ports Authority. The reason for collecting qualitative data initially was to formulate an understanding of the current practice for project selection based on the experience of experts within the Ports Authority and to benchmark the current practice to the guiding theory and best practice on project selection and prioritization. As a deductive outcome of the data analysis of the qualitative research, the research developed a customized project selection model for the Ports Authority. The second quantitative phase followed up on the qualitative phase for the purpose of testing the project selection criteria identified through data analysis of the qualitative research. The quantitative research also tested the effectiveness of the project selection model, in prioritizing an infrastructure capital investment programme, by using quantitative research techniques. The process flow in Figure 3.3, illustrates the two phase process followed in conducting this research. The research followed a multi-strategy research through triangulation using the qualitative approach for primary data collection in the first phase and the quantitative approach for primary data collection in the second phase of the research.

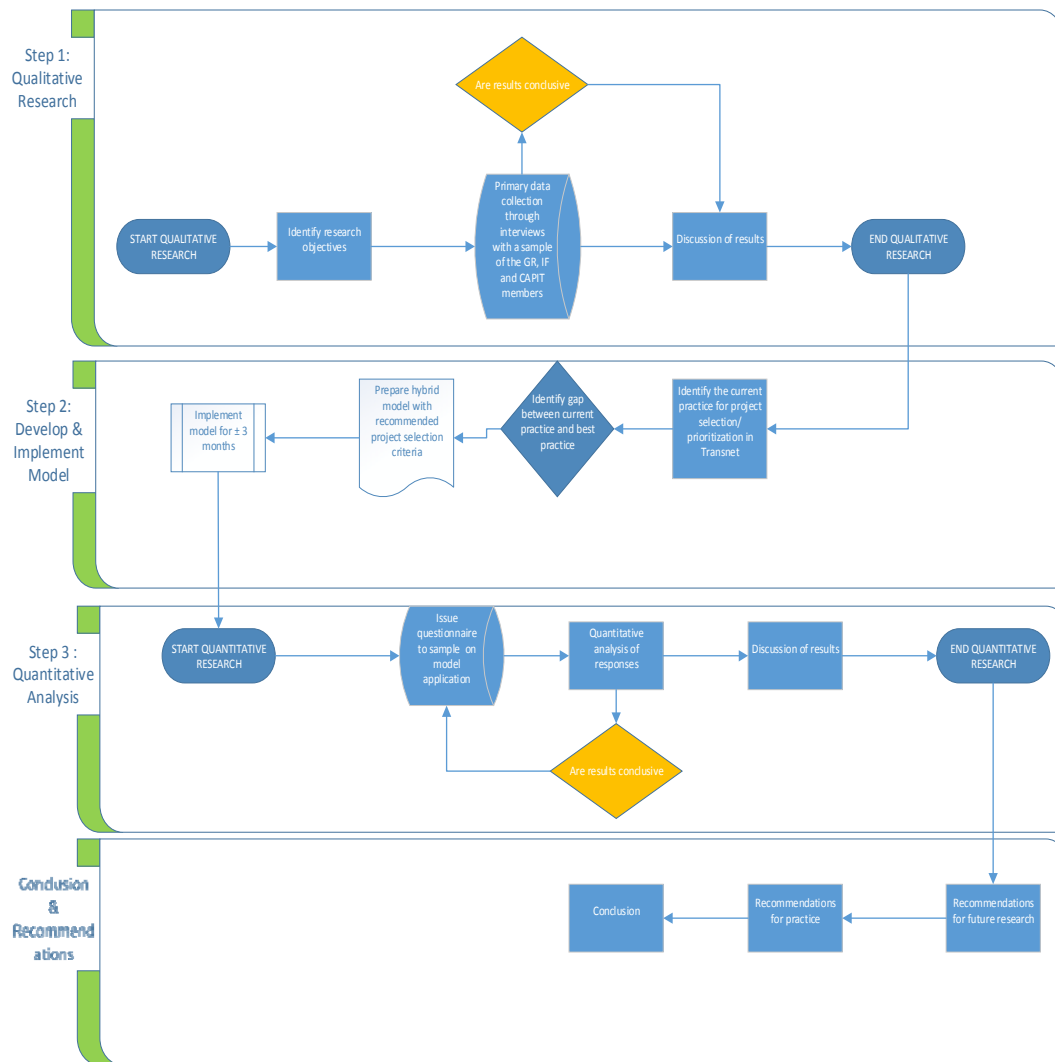


Figure 3.3 - Research Methodology Process Map

3.6 Population and sampling

According to Cooper and Schindler (2001:24), the target population in research relates to focuses, elements or data items that could be included in the study, given the relevant specific circumstances. A target population includes all the participants who meet the specific benchmark identified for a research analysis. The Port Authority's service offering is targeted predominantly at port users (which include terminal operators, shipping lines, ship agents, cargo owners and clearing & forwarding agents). As such, the Ports Authority manages eight commercial seaports along South Africa's 2,954-km coastline. These ports are Richards Bay, Durban, East London, Ngqura, Port Elizabeth, Mossel Bay, Cape Town and Saldanha. The Ports Authority in South Africa provides a service offering divided into two major categories: (1) The provision of port infrastructure; and (2) The provision of maritime services. Maritime services include dredging, aids to navigation, ship repairs and marine operations. The infrastructure department, shown in figure 3.4, was the focal point of this research and comprised the research population as these employees are directly involved and/or impacted by the infrastructure investment programmes at the Ports Authority. The infrastructure department comprises of 108 employees in total. This

infrastructure department with 108 employees is the target population for this study. Figure 3.4 illustrates the high level tree diagram illustrating the organizational structure of the Ports Authority detailing the infrastructure department within the Ports Authority.

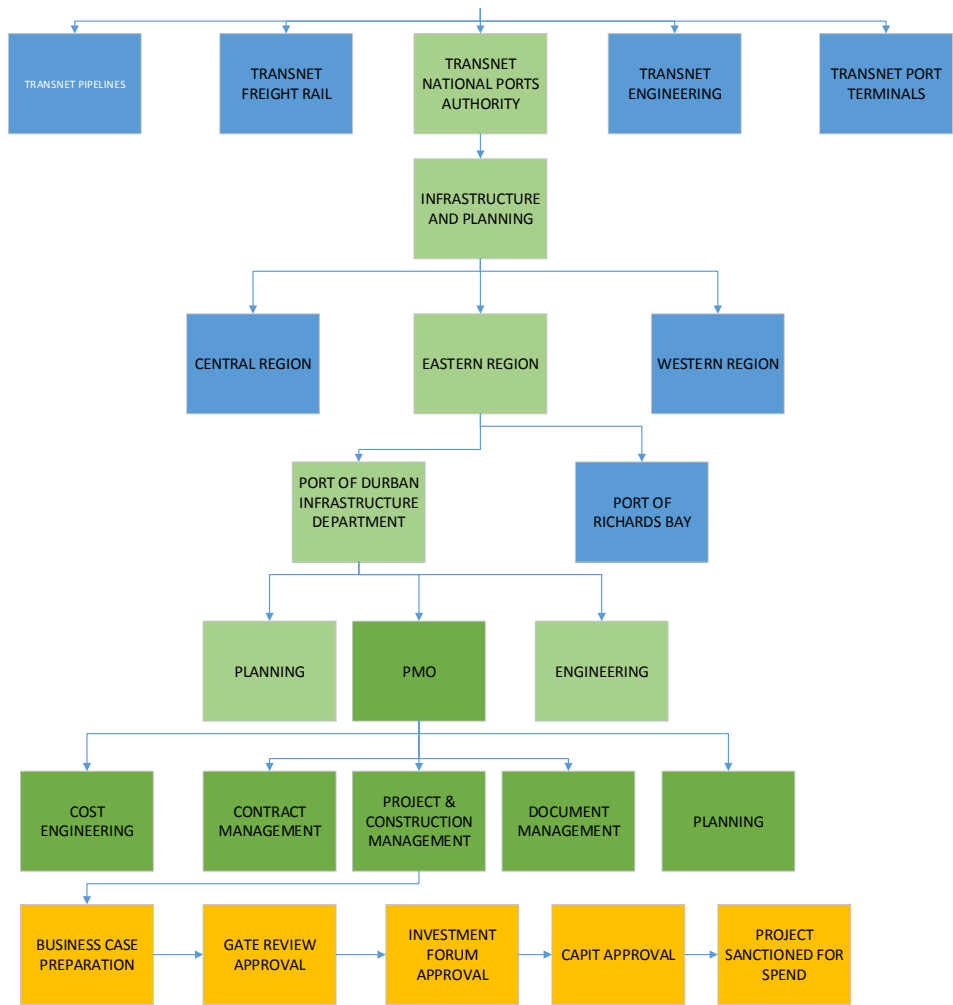


Figure 3.4: Tree Diagram illustrating the organization structure of the Ports Authority, Transnet

3.6.1 Sampling technique

According to Saunders et al. (2012: 272), sampling techniques allow a researcher to minimise the amount of data that is required for the study by only analysing the “sub-group” rather than “all possible cases or elements”. Furthermore, Saunders et al. (2012: 272) have indicated that although a researcher may be conducting their study based on a case study of a single large organisation, as is the case for this study where the Ports Authority infrastructure department was the object of the study, some form of sampling will have to take place. Saunders et al. (2012: 275) indicates that there are two sampling techniques namely probability or representative sampling and non-probability sampling. Probability sampling is further defined where the opportunity for each case to be chosen from the target population is known and the same for all cases. Non-probability sampling is defined where the opportunity or probability for each case to be chosen from the target population is not known and the research

questions which require statistical interpretations cannot be answered with ease. Since this particular study was a case study on the Ports Authority infrastructure department, responses to the research questions, a non-probability sampling technique was adopted.

3.6.2 Qualitative sampling

Saunders et al. (2012:300) lists the non-probability sampling techniques as quota sampling, purposive sampling, volunteer sampling and haphazard sampling. The purposive sampling was utilised for this study. The main aim of purposive sampling, according to Saunders et al. (2012:300), is to emphasis particular characteristics of a population that are of concern to a researcher, which will best give a response to research questions. Since the purposive sampling technique was utilised in the qualitative study, critical case technique was also employed. According to Cooper and Schindler (2001:76), critical case is a technique utilised for research where a single case (or small number of cases) can be conclusive in explaining the phenomenon of interest. This was further supported by Saunders et al. (2012: 302) that the collection of data is done to gain insight on what is happening in that case so that logical generalisations can be concluded.

The purposive sample of experts is indicated in yellow on figure 3.4. These employees were integral to good governance and approvals for infrastructure development within the Ports Authority. The sample was selected based on the research approach being used, homogeneity of participants, availability of time and resources, accessibility of the participants and the field of expertise and knowledge areas to competently respond to the research questions. According to Magang and Kube (2018:166-173) the chief purpose of a governed business environment is to provide a structured approach by which the leadership and management can be directed, controlled and held to account. Governance within state-owned entities serve as enablers in aligning strategy and leadership decisions to contribute to the State-owned Entity's, as well as, South Africa's development objectives through delivering what is promised within the correct timelines, cost commitments and realised business benefits. Governance fosters an environment and culture of transparency and accountability for the decisions made with proper line of sight to support effective decision making and risk management. It also guides and enables efficiency and effectiveness of delivery through the use of applicable policies and best practice methodologies, processes, and systems. Within the state-owned entity, the role of governance is to implement and embed the applicable state-owned entity capital policies; methodologies and standard operating procedures (SOP's) within its various operating divisions. The key objective is to ensure accountability; transparency; auditability; risk reduction and compliance by ensuring:

- I. Capital management & delivery is executed in line with the SOE Project Lifecycle Process (PLP)
- II. Asset maintenance is executed in line with the Asset Maintenance Policy & Procedures
- III. PFMA compliance
- IV. Training and audit compliance

The constituents of the sample hold various levels of employment from decision taking capacity to executing the decisions taken and are considered experts in their field by virtue of the skills, knowledge and greater than three years of experience added to the positions they hold within the organisation. The researcher selected the expert sampling technique, a type of purposive sampling, to consolidate knowledge from individuals that had subject matter expertise. The expertise in governance procedures applied in capital approval was required during the

exploratory phase of qualitative research, to highlight potential new areas of interest to be explored in the next phase of qualitative interviews as well as avenues to be encompassed in developing the selection model. As shown in table 3.2, the qualitative sample size was determined through purposive expert sampling (a non-random strategy) from twenty (20) respondents based on subject matter expertise and experience (> 3 years) who form members of gate review, Investment Forum (IF) and Capital Investment Committee (CAPIC) approval forums within the National Ports Authority in South Africa. The sample was selected from within the population of the infrastructure department as shown in figure 3.4.

Table 3.2: Design of the Study for qualitative research

stage	primary data collection
Research Approach	pragmatism
Research Method	qualitative
research strategy	deductive
sampling technique	purposive – sampling (a non-random strategy)
recommendation	development of project selection model in the Ports Authority based on good practice

3.6.3 Quantitative sampling

The selection of the sample size is of utmost importance to draw accurate and reliable inferences of the population under study (Creswell and Clark, 2017:130-150). There were a total of 108 employees that constituted the study population that were involved or impacted directly by the capital approval process for infrastructure projects. The sample was selected using simple random sampling where all attendees that attended the workshops at all eight ports were asked to complete questionnaires. Non attendees were not administered with a questionnaire. The minimum required sample size was calculated using the recommended formula for a population of 108 respondents as shown in figure 3.5:

$$\text{Sample size (n)} = \frac{\frac{z^2 \times p \times (1-p)}{e^2}}{1 + \left[\frac{z^2 \times p \times (1-p)}{e^2 N} \right]}$$

Hence n = 4.27

Where,

N = population size: 108

p = percentage or proportion of selection: 0.5

e = margin of error: 0.05 where the confidence level is 95%

z = z score or the number of standard deviations a given proportion is away from the mean: 1.96

Figure 3.5: Calculating the sample size [Source: Cooper and Schindler (2001:175-181)]

From historical evidence over the previous three years where only 70% of all invitees actually attend a workshop of this nature within the Ports Authority, the sample size was calculated at 75 (70% of 108). A confidence level

of 95% was considered for this study with an acceptable margin of error of 0.05. Although the researcher anticipated self-selection bias – where respondents may choose to participate because they have a particular interest in the subject matter and convenience bias – only attendees of the workshop were administered questionnaires, the sample was still considered to be a good representation of the population as there was a fair representation from all genders, levels of seniority, knowledge, experience and departments of the population. Whitehead and Schneider (2016:1-160-200) recommend consideration of the following factors in sample selection for quantitative analysis:

- i. Margin of error – This describes the degree of precision in research data. It is the range corresponding to the value being measured, often represented in percentage points (e.g., $\pm 2\%$). A narrower margin of error will require a larger sample size.
- ii. Confidence level – This represents the uncertainty associated with an estimated data range. It estimates the probability that the true value being sought will present itself within the margin of error around the estimate. A higher confidence level will require a larger sample size.
- iii. Power – power gives credence to finding significant evidence of difference in the data group provided that there is a difference in the population. A higher power requires a larger sample size.
- iv. Effect size – When several groups occur in a sample, the estimated difference observed between the groups is known as the effect size. For the effect size to be larger and reflect a difference with a specified power, the sample size must be larger.

3.7 Data collection instruments

3.7.1 The interviews

Merriam and Tisdell (2016:137) state that the principal source of data for qualitative research is interviews and observations. Observations are generally utilised in case studies. Merriam and Tisdell (2016:137) asserts that informal interviews are usually intertwined with observations. Interviews joined with a questionnaire, observations and document analysis creates a platform for an all-inclusive interpretation of the phenomenon being investigated. Saunders et al. (2012: 388) describes a research interview as a “purposeful conversation between two or more people” which entails the interviewer acquiring a relationship with the interviewee in order to extract information from them through asking questions that are succinct and unequivocal. Evidently, this is about asking questions which are purposeful and thereafter cautiously paying attention to responses in order to interrogate the responses further. Saunders et al. (2012:390) describes three types of interview categories being structured interviews, semi-structured (in-depth) interviews and unstructured interviews. In this study, primary data was collected through semi-structured questionnaires using an interview guide. The interview guide was compiled based on questions that were constructed that would ensure that optimal research results were obtained.

3.7.2 The questionnaire

For the qualitative research, a semi-structured questionnaire was designed with the intention of achieving fluid and unrestricted responses. The topic guides and questionnaires were developed based on the research question. The questionnaire was divided into three categories with up to ten sub-questions in each category. The first

category intended to glean knowledge with respect to how decision-makers experienced the key challenges with project delivery. In this section, the interviewer aimed to identify the current challenges (if any) with project delivery at the Ports Authority. The second category sought to gather experience from the participants on investment decision making in State-owned Entities within South Africa, with particular focus on the South African ports, in comparison to other international ports. The third category was based on project management best practices in Southern Africa. In this section, the interviewer intended to identify the contributors to project selection and prioritization by reviewing the port objectives against the port tariff methodology and aligning them to the prioritization of infrastructure in South African ports. The questionnaires and interview transcripts for the qualitative research can be found in Appendix 1 and Appendix 2 respectively.

The quantitative research used self-administered, closed-response questionnaires designed around the core research objectives. The questionnaire was used to gain insight into the strategic decisions that influence project selection within the Ports Authority. A Likert-type scale was selected for the questionnaire; with a simplified five-point scale ranging from strongly disagree to strongly agree. According to Sharma (2018:1-12) and Cooper and Schindler (2001:160-200), the ordinal scale is best employed for identification and magnitude of research data. This scale was useful in measuring the perceived selection criteria and commercial impact, as well as to compare and analyse results. The questionnaire was prepared to guide the collection of the correct data in a structured and logical format. The questions were structured to gauge an understanding of the relevant issues impacting project selection after application of the project selection model developed as an outcome of the qualitative research. The questionnaire was clustered into various sections that focused on fundamentals for project selection, analysis, prioritization and success. The research instrument (Appendix 4) consisted of 13 items, with a level of measurement at a nominal or an ordinal level. As described in table 3.2, the researcher adopted a pragmatic approach for the research design to encourage a practical description of the processes, procedures, critical success factors and limitations of the current capital approval process used within the organization. The pragmatic approach required central importance be given to the research question rather than an analysis of philosophical theory. The questionnaire was divided into 4 sections to collect data on the research objectives as well as the dependent and independent variables as follows:

- 1 **Biographical data** – This section was used to assess the demographic information aligned to the key attributes of the sample selection. The respondents were required to indicate number of years of experience in their current role within the organisation, their job category and their region of influence within the Ports Authority. This information was critical in order for the researcher to ensure that the respondent was a good representation of the target population and was sufficiently knowledgeable about the context and the content of the research.
- 2 **Key contributors to Project Selection and Prioritisation** - This section was designed to test the effectiveness and ease of use of the project selection model. The researcher was able to ascertain success of the model's implementation and gauge areas recommended for improvement in project selection using the model. The empirical and theoretical reviews recommended utilising a ranking or prioritisation model to ensure that projects selected within the various investment programmes would assist the Ports Authority in achieving its strategic business objectives. To support organisational objectives, a transparent, objective and quantifiable approach to prioritising capital and other projects must be applied

(Wheeler, 2013: IV). This model would be used to generate optimal portfolio options based on approved capital management principles and organisational affordability.

- 3 **Strategic Alignment** – This section of the questionnaire was designed to test the respondent’s feedback on the project selection criteria. The researcher intended to investigate if the model’s project selection criteria guided project selection to align with Transnet's strategic objectives.
- 4 **Project Selection and Ranking improves investment decisions** –The literature review had already established that the project selection model affected critical decision making in capital investment with respect to selecting the right project portfolio with the balance and mix of projects to support the business strategy. Therefore, by combining discussions in literature review, analysis of the qualitative interviews and international best practice of selecting projects, the researcher proposed a process or framework for project portfolio selection to ensure successful realization of corporate strategy. In this section of the questionnaire the respondents were required to rate their experience on whether the model contributed to business success through improved investment decision making guided by the project selection model.

3.8 Data collection techniques

According to Kothari (2004:95) conducting qualitative research interviews requires the use of several skills, such as attentive listening and note taking, but also cautious planning and sufficient preparation. Furthermore in a semi-structured interview, the researcher provides some structure based on her research interests and interview guide, as well as flexibility with the interview guide to allow for the respondent’s more spontaneous responses. Rajasekar, Philominathan and Chinnathambi (2013:112) also commented that in a semi-structured interview, the researcher has an action plan consisting of open-ended questions concentrating on different parts of the particular research issue. In this study, semi-structured interviews and semi-structured questionnaires were used. Qualitative data collection techniques are generally focused on attempting to comprehend the main motives for the study therefore the techniques are usually more in-depth. Kothari (2004:95) also pointed out that qualitative research data in the form of words is collected through interviews, observations, work of art and documents. According to Cooper and Schindler (2001:334), an interview is still the most predominantly utilised technique to collect data for qualitative research. Furthermore, Cooper and Schindler (2001:334) define interview as “depth”, “exploratory”, “semi-structured” and “unstructured” with the aim of seeing the research topic from the viewpoint of the interviewee and they came to have that certain viewpoint. Cooper and Schindler (2001:335) asserted that qualitative interviews may differ on how they are conducted, they may be conducted face to face, or a telephonic conversation may take place or even through the internet. Kothari (2004:101) defines a questionnaire as a form consisting of a number of questions arranged in a definite order. For this study, the questionnaires were distributed to the research participants during a workshop for the purposes of quantitative data collection. The key merits of using the questionnaire were identified as being low cost, free of bias from the interviewer and convenient in that the respondents had sufficient time to carefully consider their responses (Kothari, 2004:102).

3.8.1 Qualitative data collection

The researcher pilot tested the research instrument with four senior employees employed within the Enterprise Portfolio Management department within the National Ports Authority. This department was responsible for developing the project portfolios to align with the business strategy. The employees were selected as subject matter experts on the projects listed on the Ports Authority corporate plan. The research questionnaire was only

distributed to respondents upon acceptance from the pilot study. A subject information letter was enclosed in the skype meeting invite or delivered in person depending on the physical location of the pilot study respondents. The information letter served to socialize the context of the study and create awareness to respondents with respect to the content and objectives of the research. The interview questions were posed to the participants and they were given an opportunity to clarify the content and expectation of each question. The questionnaires were available in English only as all participants were fully conversant in the English language. The researcher ensured that the process was conducted in an ethical and morally sensitive manner and that participants were not coerced into submitting questionnaires. The topic guides and questionnaires were developed based on the research questions. Questions were not leading and designed to be open ended to encourage discussion and debate amongst the respondents. The respondents were encouraged to bring up any issues of relevance that were not directly prompted by the facilitator. The questionnaires and subject information letters for the qualitative research can be found in Appendix 1.

Table 3.3: Data collection for qualitative research

data collection	A qualitative approach was used to conduct this research using semi structured interviews
data analysis	Transcribed, coded, counted, analysed
validity and bias	multi strategy research using Mixed Methods Exploratory Sequential Design, triangulation through mixed methods approach
population	108 employees comprising the Infrastructure department within the Ports Authority
sample	20 employees who were members of gate review, Investment forum and Capital Investment Committee based on subject matter expertise and experience (> 3 years) within approval forums of the Ports Authority

The method for data collection through the qualitative research is summarised in Table 5.3. Primary data was collected through semi structured interviews. The main method of data collection was through face to face or skype interviews. The questionnaire was issued with the electronic meeting invite to guide the interviews. The intention of the interviews was to encourage participation and bring the respondents together in a non-threatening environment to share knowledge on issues where they had knowledge and experience. The interview guide was issued ahead of the interview. This was considered by the researcher as the most optimal manner of obtaining the best results with the interview data collection method. The interviewee thereafter accepted the formal appointment. On the date and time scheduled for the interviews, the participants were given a brief summary of the research, intended objectives and processes to be followed. Each respondent was introduced to the purpose of the study, the ethical obligations of the researcher and purpose of informed consent prior to the interview. The researcher also explained that the participants' details would kept confidential. Thereafter the researcher gave details regarding how the interview would be conducted following the form of the researcher posing the questions in the order of interview guide and the interviewee responding and elaborating on their responses including that the interviewee's responses would be voice recorded. The researcher facilitated interviews and hence took minimal notes relying heavily on the audio recording which was later transcribed. There was no pressure on

respondents to reach consensus on their responses. If respondents were not comfortable answering a question, they simply skipped the question and continued with the intention to return to the question if they so wished. The interviews were facilitated by the researcher who introduced the research topic, coordinated the discussion and probed for more information on themes of interest. Semi-structured interviews allowed the researcher to probe subject matter experts for deeper clarity based on their application area knowledge and experience within the port environment. The individual, anonymous interviews encouraged a confidential platform where respondents were able to express their views, recommend solutions and map a suitable way forward based on their particular expressions of interest. Follow up questions were asked during the interview in order to obtain clarification and more in-depth information. The questionnaires were completed by the respondents and emailed to the researcher in instances where the research was remotely based and the researcher could not collect the questionnaire after a face to face interview but had skype interviews instead. When the interview was concluded, the researcher thanked the participants for participating in the study and explained that all the participant responses would be consolidated, through the notes taken during the interview and the voice/audio recordings. The researcher also explained that, if during the consolidation, it was noted that further follow up questions were required, the researcher would request the additional information by sending emails to the interviewees requesting the additional clarification information. On completion of the interview, voice recordings of the interviews were collated by the researcher as in Appendix 2. After the interviews, the data was transcribed using a software that converts the voice recordings into text.

3.8.2 Quantitative data collection

The process for data collection in the quantitative research is summarized in table 3.4. The model was implemented within the organization over a period of 6 months before the researcher began the quantitative research process. A focus group interview was conducted with an identified number of employees (four) within the EMPO office within the National Ports Authority, in order to finalize the design and content of the questionnaire. These selected employees were not included in the study sample. Due to the various levels of governance and approval authorities within the Ports Authority, the researcher was bound to comply with due diligence by getting acceptance of the research and content of the study at the Infrastructure Executive Committee and the Capital Investment Committee prior to proceeding with the surveys. The study was accepted for a six month pilot implementation of the project ranking and prioritization model at all ports.

Table 3.4: Data collection for quantitative research

data collection	5 point Likert Scale
data analysis	means, frequencies and standard deviation
validity and bias	Exploratory Sequential Design, triangulation through mixed method research approach, CONTENT VALIDITY: a pre-test and pilot test of the questionnaire with at least four regional program managers within PMO CONSTRUCT VALIDITY: Theory evidence

population	The population size is 108 and comprises the infrastructure department within the Ports Authority
Sample	Simple random sampling – 75 participants
confidence level	95%
margin of error	0.05
data collection	Self-administered close response questionnaires

Quantitative data was collected using a survey questionnaire. The researcher co-ordinated workshops at each of the eight ports within the Ports Authority. The agenda for these workshops included a clean-up of the existing corporate plan by identifying those projects that were unlikely to be approved during the financial year or were no longer needed. This exercise created a convenient backdrop to explain the context of the research, the processes that had been followed to date and the purpose of the quantitative research. The workshop was also used to present the prioritization model that was developed by the researcher, to implement the model and thereby prioritize the capital portfolio of projects within each port. A subject information letter was thereafter distributed to employees to create awareness of the context of the research. The researcher administered questionnaires to all attendees who agreed to participate in the research. The letter for informed consent was attached to the questionnaire and each respondent was required to sign the informed consent before completing and handing in the questionnaire. The questionnaires were made available in English only as all employees were fully conversant in the English language that is used as the medium for business communication within the Ports Authority. The researcher ensured that the process was conducted in an ethical and morally sensitive manner. None of the participants were coerced into submitting questionnaires. At the end of the workshop, all questionnaires were handed back to the researcher whether they had been fully, partially or not completed.

3.9 Data analysis

3.9.1 Qualitative data organisation and analysis

According to Aronson (1995:1-4), when information has been collated, a researcher will have to decide on how to analyse the data. There are many ways to analyse the data, especially when individuals provide information about their experiences. A thematic analysis can be used to analyse the qualitative data. Aronson (1995:1-4) declares that thematic analysis places an emphasis on recognisable themes and patterns of behaviour. Aronson (1995:1-4) commented that since interviews are utilised as the research tool for the qualitative research, feedback from the interviews and questionnaires must be analysed, and patterns of experiences documented. Thereafter the patterns that have been identified should be explained and developed. According to Saldaña (2015:1-32) coding of transcripts in qualitative research will summarise and capture the essence of the datum's primary content. The research used simultaneous coding to code the data for analysis. Saldaña (2015:1-32) recommends the categorization of the codes to organize and group data that shared similar characteristics or referred to the similar constructs, concepts, models and theories in the management of portfolios of projects within the corporate context. The qualitative data analysis for this study followed a thematic analysis approach, once all the data was collected through interviews. According to Aronson (1995:1-4) themes are "bringing together components or fragments of ideas or experiences, which often are meaningless when viewed alone". The qualitative questionnaire was divided

into three categories with up to ten sub questions in each category. The qualitative data was collected in terms of written notes and voice/audio recordings. The written notes were compiled into a report format, which made it simpler for coding purposes. The written notes were easily readable and interpreted. The voice/audio recordings were also translated into word written document in the form of a report, similar to the written report from the notes. The written report of data collected in written format and voice recording was analysed for common themes and issues raised by the participants. Commonality were extracted on responses to questions where participants seemed to have strong views. After the interviews, the data was transcribed using a software that converts the voice recordings into text on Microsoft Word v. 2010. The transcriptions were organized on an excel spreadsheet for coding and analysis. The researcher used an old style of coding and analysis due to lack of training on the qualitative analysis software available e.g. Nvivo, Atlas.ti or Hyper Research. The transcriptions were coded by reading through the transcriptions several times to identify key words, phrases, repetition, surprises, key themes and/or ideas.

The Lean Six Sigma processes to define, measure analyse, improve and control (DMAIC) guided the researcher on the process to follow in coding and analysing the qualitative data (Alexandra and Pinto, 2014:912-920). The researcher felt comfortable using the Lean Six Sigma approach due to being qualified and experienced with the processes. Lean Six Sigma comprises all the Lean and Six Sigma tools for waste elimination and reduction in defects by implementation of the DMAIC model. Alexandra and Pinto (2014: 1-920) successfully implemented a Lean Six Sigma (LSS) project management process improvement model in a real enterprise environment which had formal and established project management systems based on the best practice standards for project management according to the Project Management Institute (PMI)(Rose, 2013:11-154)(Singh, 2019:592). Drawing from the Six Sigma methodology, a fishbone diagram was applied in determining the categories of the codes (Alexandra and Pinto, 2014:912-920) (Pyzdek and Keller, 2014:114-120). The fish bone tool encouraged the researcher to identify categories based on root causes of the coding applied to the transcripts. The researcher thereafter systematically evaluated and analysed the codes to confirm the critical root causes of the problems identified in each of the categories by engaging in a process of elimination. The Lean and Six Sigma approach by Alexandra and Pinto (2014: 1-920), the root causes were interpreted and critiqued to draw meaningful conclusions about the problems identified in the interviews. The transcriptions were coded by identifying key themes, ideas or repetition. Using a funnel and gate approach to shortlist the codes, the data was analysed. The data analysis also used graphical and statistical techniques outlined by the Lean Six Sigma philosophy using the Minitab software (Brook, 2010: 463). The combination of Lean Six Sigma with Minitab teaches statistical tools and concepts in the context of quality improvement. By controlling each of the inputs and responding to deviations in time, yield will only need monitoring to maintain process control. The researcher is also very familiar with the Minitab software used to code and analyse Lean Six Sigma data. After coding and data analysis, the results were interpreted for relevance to the research objectives and used in the development of a project selection model to prioritize infrastructure projects within the Ports Authority in South Africa.

The researcher used the project selection criteria identified through the coding and analysis of the interview transcripts to develop the project selection model. The project selection criteria were determined based on

recommendations from the interviewees and data analysis. The model was based on good practice and incorporating the value engineering contributed by respondents through the analysis of the qualitative research.

3.9.2 Model development:

To support organisational objectives, a transparent, objective and quantifiable approach to prioritising infrastructure projects was applied by implementing a project prioritisation model (Calafiore, 2017:55-87) (Jones, Moura and Domingos, 2014:400-409)(Nonino, 2017:245-263) The model was implemented to guide projects selected within the various portfolios to assist the Ports Authority in achieving its strategic objectives. While selection and prioritization models have been used successfully across the globe, the actual metrics used to rank and select projects is specific to each organisation (Nonino, 2017:245-263). A quantitative study by Njue et al (2016:1-13) investigated the relationship between strategy alignment and the overall performance of project portfolio management using self-administered survey and multiple regression analysis techniques. The study revealed that project portfolio management performance was directly influenced by the strategic alignment between projects and organizational core obligations. From some of the pertinent literature reviewed in this study, it was evident that every organisation determines its own unique criteria and weights those criteria based on organisational values, strategic direction, organizational goals, available resources, and so on. Projects are then scored and prioritized based on the selected criteria. Once projects are prioritized and those priorities are reviewed and discussed, the organisation can evaluate the results to determine funding and resource allocation for the higher priority projects. A final step involves assessing how and when (or if) to fund the lower priority projects in the future if/when more resources become available(Calafiore, 2017:55-87) (Jones, Moura and Domingos, 2014:400-409)(Nonino, 2017:245-263). The academic benefits of project selection, ranking and prioritization have been explored in the literature review chapter of this research and were established through the outcomes of the qualitative interviews. The researcher combined analysis of the data from the qualitative interviews with discussions in literature review and findings in current practice of selecting projects, to propose a process and model for project portfolio selection to ensure successful realization of corporate strategy. The model was an optimisation tool to select and rank projects based on objective criteria that were listed on the organisation's corporate plan for each financial year. The corporate plan, that was previously used within the Ports Authority for financial forecasting of spend on projects in each financial year, was used as the basis for the development of the project selection model as per the process in Figure 3.6.

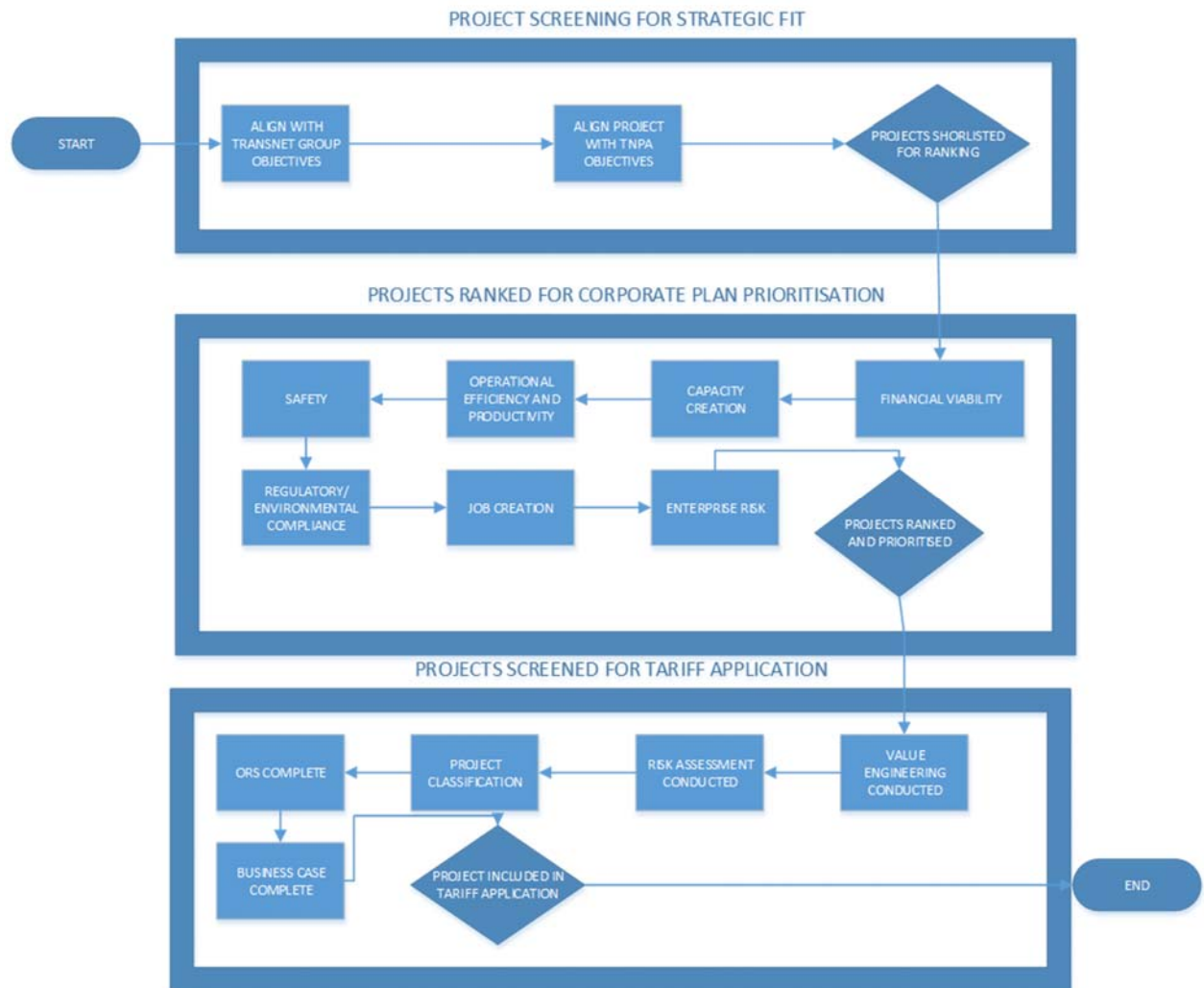


Figure 3.6: Process for development of Project Selection Model at the Ports Authority

Columns were added into the corporate plan to include the process in Figure 3.6.

- I. Step 1 - Business strategy supported by the Department of Public Enterprises strategic objectives for State-owned Enterprises (Department of Public Enterprises, 2019), Transnet 4.0 strategy (Transnet, 2019), National Ports Plan (Transnet National Ports Authority, 2014), the Port Development Framework Plan (Transnet National Ports Authority, 2014), the Port Master Plan (Transnet National Ports Authority, 2014), the Fleet plan (Transnet National Ports Authority, 2014). This created a screening to shortlist projects that were aligned with the corporate strategy.
- II. Step 2 - Project selection criteria identified as an outcome of the qualitative analysis and interpretation. This included financial viability, capacity creation, operational efficiency and productivity, safety, regulatory and environmental compliance, job creation and enterprise risk. The projects were ranked and prioritized after this process based on ranking and weighting scales, prioritization scores – as determined in consultation with each business unit, moderated scores – entered by the Enterprise Project Management Office
- III. In the final step, Step 3, projects were screened for inclusion in the Ports Authority tariff application by including columns for documentation requirements e.g. an approved owner requirement specification, an

approved business case, schedule, risk analysis, cost estimate, value engineering etc. (Meyiwa and Chasomeris, 2016:1-20) (Mchizwa, 2014:36-41).

The process for detailed development of the model was explained in Chapter 4 of this research. The model was reviewed by various committees within the Ports Authority prior to approval for implementation i.e. Project Management Office, the Infrastructure and Planning Executive Committee and Ports Authority Capital Approval Committee. The model responded to the “how” component of the research question. This model was used to generate optimal portfolio options based on approved capital management principles and organisational affordability. This process can also be easily and practically adapted by other state owned enterprises in South Africa and globally.

3.9.3 Quantitative data organisation and analysis:

Kothari (2004:5) describes quantitative research analysis as a “formal and rigid” analysis of data using “inferential, experimental and simulation approaches” to research. The inferential approach serves to form a basis from which to “infer characteristics or relationships of population”. Once all questionnaires were collected, the researcher started to collate and analyse the data. The responses in the form of raw data were thereafter coded, counted and analysed. The data collected from the responses was analysed with SPSS version 25.0 software offered by UKZN which included the use of descriptive statistics such as means, frequencies and standard deviation. The results were presented using the descriptive statistics in the form of graphs, cross tabulations and other figures for the quantitative data that was collected. Inferential techniques included the use of correlations and chi square test values; which were interpreted using the p-values (Kothari, 2004:5). The hypothesis was tested using structural equation modelling. Responses were compared to ascertain whether the results obtained were significant rather than co-incidental. The researcher also analysed and interpreted the biographical data of the respondents. An analysis was conducted to ascertain if there was a causal relationship between the respondent’s numbers of years of industry specific experience, role in the organization, region of influence within the Ports Authority’s project management office. Kothari (2004:124) states that these types of data are known as “statistics of variables and are classified on the basis of class intervals”. The strength of relationship between these variables was investigated using statistical process control. Statistical process control was used to identify the difference between common cause and special cause variation in a process. Once the control limits of a process could be tracked, the process performance could be tracked against these control limits and adjustments or modifications to the process could be made when the data points were out of limit (Creswell and Clark, 2017:203-216). It must be noted however that a process is not just out of control if it exceeded the control limits. The two most important aspects of precision are reliability and validity (Cooper and Schindler, 2001:211-215). Reliability is computed by taking several measurements on the same subjects (Creswell and Clark, 2017:203-216). A reliability coefficient of 0.70 or higher was considered as “acceptable”. The reliability scores for all sections exceeded the recommended Cronbach’s alpha value. This indicated a degree of acceptable, consistent scoring for those sections of the research. The researcher thereafter employed the use of factor analysis, only for the Likert scale items, as a statistical technique whose main goal was data reduction. A typical use of factor analysis is in survey research, where a researcher wishes to represent a number of questions with a small number of hypothetical factors (Creswell and

Clark, 2017:203-216). In all instances, the conditions were satisfied which allowed for the factor analysis procedure. Section analysis was used to summarize percentages for the variables that constituted each section. Results were then further analysed according to the importance of the statements. Data analysis was also done using inferential statistics. The Chi Square test was used where a p-value was generated from a test statistic. A significant result was indicated with " $p < 0.05$ ". Bivariate correlation was also performed on the (ordinal) data. The impact of the data correlations were used to interpret the results in testing the hypothesis and addressing the objectives of the research.

3.10 Interpretation of results:

A fundamental process in the interpretation of results for each of the qualitative and the quantitative phases of the research was the triangulation of the results (Creswell and Clark, 2017:203-221). The qualitative research made use of coding, organising and analysing the data from the qualitative interviews. The project selection criteria from the qualitative phase of the study were used to develop the model for project selection and prioritization of capital investment at the Ports Authority. After six months of implementation of the model, the researcher conducted the quantitative research. The quantitative data analysis included reliability statistics, factor analysis, section analysis, cross tabulations and correlations where comparisons were done against the biographical data. In almost every instance respondents agreed that there was an improvement in operations after the project prioritization model was implemented. The feedback received from respondents was also analysed in terms of the main and sub objectives of this research. Improvements were indicated in the areas of strategic alignment between business operations and infrastructure development, governance and due diligence, objectivity in screening and prioritising projects and the impact on investment decisions.

3.11 Validity and reliability

Cooper and Schindler (2001:211-215), indicated that the important indicators of the quality of data measuring instruments are the reliability and validity of the measures which are focused on decreasing inaccuracy in the measurement process. Galdas (2017:1-2) defines validity and reliability as “measures of trustworthiness”. To ensure validity and reliability of the research, a pilot test of the both the qualitative and quantitative questionnaires were conducted with at least four senior management employees who were in a position to critically assess the questionnaires in terms of face validity and content validity. This test group was excluded from the data collection. The relevant role-players confirmed the information collected from the various sources as acceptable in terms of construct and content. The key reason for sampling was to improve the validity of the research. Sampling was critical to external validity which refers to the extent to which findings of a study can be generalized to the entire population or context of the study (Cooper and Schindler, 2001:211-215). The research proved to be generalizable since a representative sample was selected from the population so that the results could be extrapolated to the population with a tangible level of confidence that it was a true representation of the population perspectives. The research validity and reliability was further enhanced by the use of different research instruments and enriched by a mix of research participants bringing diversity, width and depth to the study. To further demonstrate reliability and neutrality the interviews were recorded (with permission) for accuracy during transcription. An intelligent verbatim transcript of the interviews ensured that the researcher’s opinions and views did not pollute the responses. To demonstrate trustworthiness, the respondents were given an opportunity to review transcriptions of their

interview to confirm the accuracy of their responses. Recorded responses were made available as part of this research.

Creswell and Clark (2017:203-221) considers triangulation to be the utilisation of more than a single method of collecting data which enables the researcher to compare data results. Triangulation allows for research results to be examined for consistency giving rise to a compatibility between findings, also enabling the inconsistencies and differences between the findings to be examined and then to demonstrate how the findings actually complement each other. The qualitative research was guaranteed to be more meaningful, impactful and objective since it would be supported by quantitative research in the process of triangulation (Galdas, 2017: 1-2). The rationale for mixed method research was multi fold with the biggest advantage being the enhancement of the significance of the research study through checking results from the first phase of qualitative research in the second phase of quantitative research (Creswell and Clark, 2017:130-150). The Exploratory Sequential Design in mixed methods research uses triangulation to enhance the validity of the research. The research done using quantitative research techniques was used to confirm, validate and clarify data collected from the first round of research conducted via qualitative interviews. The researcher also tested the data results and analysis using the Lean and Six Sigma process. To ensure content validity, a pilot test of the questionnaire with at least four regional programme managers within the EPMO was done in each phase of the study. To ensure construct validity, the research used theoretical literature reviews, frameworks and models already implemented elsewhere. The validity tests ensured that any variance explained was the result of the underlying phenomenon and not a result of poor research technique. Hence the assumption would be that qualitative research that is supported by quantitative research would be more meaningful, impactful and objective through the process of triangulation.

3.12 Limitations of the study

The researcher implemented the prioritization model for the selection, ranking and prioritization of capital investment projects in the project lifecycle FEL 3 feasibility and FEL 4 execution phases of the project. The study assumed that due diligence was applied in the conceptual, initiation and pre-feasibility phases of projects which are not funded out of capital investment but rather from operational expenditure. The draw back to this assumption was that organisations, such as the Ports Authority, often expend vast resources in terms of time, money and personnel in extensive optioneering of projects without carefully applying the selection and prioritization techniques recommended in this research. Once the optioneering is complete and the project is ready to progress into execution, organisations are remiss to defer or cancel these projects. The challenge is that without clear performance metrics and project selection criteria any expenditure that is fruitlessly and wastefully employed is deemed a PFMA violation as per Public Finance Management Act No 1 of 1999 Government Gazette 40637 dated 24 February, 2017. Hence these projects naturally progress to execution at the opportunity cost of projects and programmes that may have had superior strategic alignment with the business intent. Therefore, the biggest limitation of the study is alignment of the conceptual, initiation and pre-feasibility phases of projects to the strategic objectives of the organization, National Ports Plan, Port Development Framework Plans and Fleet Plans for the project prioritization model to be truly effective. Unfortunately, many of these master plans are not available. Hence for this model to be effective truly serve its purpose, the similar process of project selection and

prioritization must be adopted in the initiation and pre-feasibility stages of the projects in the project lifecycle FEL 1 initiation and FEL 2 pre-feasibility phases of the project. The recommendation for future research is to implement a similar model for the FEL 1 and FEL 2 phases of projects which typically use operational expenditure i.e. not capital investment. The advantage of the model in the initiation and pre-feasibility phases of the project will provide a 'cradle to grave' approach in driving capital expenditure in line with the strategic objectives of the organisation.

3.13 Ethical considerations

Cooper and Schindler (2001:112) expressed a view that there are many motives why it is vital to follow ethical norms in research. Observing ethical norms allows for the promotion of objective research, such as "knowledge, truth, and avoidance of error" (Cooper and Schindler, 2001:112). An ethical consent form seeking permission to conduct the study was approved by the Chief Executive of the Ports Authority. An ethical clearance form was also approved by the research panel at UKZN – GSBL (Appendix 13). This study ensured that the participants were not subjected to harm in any way and were respected at all times during their participation in the study. Informed consent was received from all participating subjects in the study prior to conducting the interviews or completing the questionnaires. Acceptable level of discretion of the research data was ensured and the privacy of individuals who participated in the research and the Ports Authority was honoured at all times. The researcher ensured that the process was conducted in an ethical and morally sensitive manner and that participants were not coerced into submitting questionnaires. The quantitative questionnaires were completed anonymously. Furthermore, the research was truthful and circumvented the exaggeration of the aims and objectives of the research. Potential conflicts of interests were to be stated upfront and none were actually declared. The communication regarding the research was done with honesty and transparency and any misleading misrepresentation of information was avoided.

3.14 Chapter summary

The research design methodology combined methods, paradigms, and the approaches of qualitative and quantitative research in the Exploratory Sequential Design Mixed Methods research. The research technique forced triangulation using the qualitative approach for data collection in the first phase of the research and quantitative approach for the second phase of data collection. Triangulation of methods enabled a broader and more comprehensive picture to emerge about the research.

In the first phase of research, a qualitative approach was used to conduct this research using semi-structured interviews with a purposively selected sample size of twenty participants who were experts in project selection for capital funding within the Ports Authority. The results of the qualitative research were consolidated, coded and analysed. The project selection criteria identified through data analysis of the qualitative data was instrumental in developing a project selection model that was implemented for the selection and prioritisation of infrastructure capital investment projects over a period of approximately six (6) months. The intention in analysis of the quantitative research was to test compliance to and effectiveness of the model application in project selection and prioritization. Once reasons for non-compliance in applying the model to align the strategic goals of the Ports Authority in project selection and/or deferral were identified and interpreted, there could be amendments to the

model with recommended improvements and implementation of the final model for roll out to all ports eight ports within the Ports Authority in South Africa. The outcome of the quantitative research was also intended to assess if there was improvement in capital spend on infrastructure development after adopting good practice in implementing a model to objectively select and prioritize projects. This improvement in capital expenditure translated into business success in meeting the requirements of the Ports Regulator South Africa. The researcher also ensured that the data and findings were an accurate reflection of the participant's knowledge and experience to confirm credibility, transferability and dependability of the data analysis and interpretations.

The next chapter presents and discusses the analysis and interpretations of findings of the qualitative data that was collected through interviews. The significant and relevant themes were documented during the interviews and are presented in the next chapter.

CHAPTER 4

DATA PRESENTATION, ANALYSIS AND INTERPRETATION OF FINDINGS: QUALITATIVE RESEARCH AND MODEL DEVELOPMENT

4.1 Introduction

This chapter presents and discusses the analysis and interpretations of findings of the qualitative data that was collected through interviews. The significant and relevant themes were documented during the interviews and are presented below. As an outcome, this chapter sought to analyse the respondent feedback received from the qualitative interviews using semi structured questionnaires. The findings of the qualitative research determined the key project selection criteria used to develop the model for selection and prioritization of projects. This chapter therefore discussed the following:

- i. Techniques adopted in the coding and analysis of the research themes
- ii. Interpretation of the results from the data analysis
- iii. Development of the project selection model based on the qualitative data analysis and interpretation

4.2 Research objectives of the qualitative research

Based on the empirical and theoretical gaps identified in the problem statement, the objective of the qualitative data analysis and interpretation was to develop a project selection model to support infrastructure investment programmes within the Ports Authority, South Africa. The sub- objectives of this phase of the study aimed to identify those quick win project selection criteria aligned to the Ports Authority's strategic objectives in order to select and prioritize projects for execution. To achieve this, the researcher aimed to benchmark the current practice against the best practice in relation to the selection, ranking and prioritization of projects at the Ports Authority, a division of Transnet SOC Ltd, a State-owned Entity; and to also identify the key contributors in project selection and decision making within the Ports Authority.

4.3 Data Collection

4.3.1 Focus group interview

In the first part of this research, the researcher used a focus group with four participants from the Enterprise Portfolio Management Office (EPMO). The focus group proved invaluable in brainstorming the questions informing the semi-structured questionnaires for the qualitative interviews. The respondents selected from EPMO were all familiar with the subject matter as the EPMO had been trying to implement a 'ranking model' within the Ports Authority for almost five years prior. The challenges experienced by the EPMO were discussed in detail and solutions put forward, to mitigate similar risks, in the interviews with sample participants that followed. The group dynamic encouraged brainstorming and idea generation. All participants, although having varied backgrounds and experiences, were familiar with the subject matter and the objective of the research. The focus group interview was cost effective and efficient. The date and time of the interview was selected to suit the availability of all participants.

The objective of the focus group was as follows:

- i. Reviewing the pitfalls and obstructions that prevented EPMO from successfully implementing the ‘ranking model’ within the Ports Authority with the intention of avoiding similar pitfalls through this study
- ii. Reviewing the ranking model and capturing changes intended to align with the subject of this research
- iii. Reviewing the minutes of CAPIC meetings, presentations and feedback at various steering committees
- iv. Aligning the strategic objectives and requirements, of the corporate head office (Transnet SOC Ltd) as well as the Ports Authority, to the project selection criteria proposed in the semi structured questionnaire
- v. Reviewing and challenging the content and construct validity of the interview questions to ensure that the respondents would not be coerced into responses
- vi. Eliminating the bias of the researcher in developing the semi structured questionnaires

On completion of the focus group interviews, the questionnaires were updated with comments and sent back to the participants to verify that the comments and suggestions had been captured correctly.

4.3.2 Interviews

The researcher selected the expert sampling technique, a type of purposive sampling, to glean knowledge from individuals that had particular expertise in governance procedures applied in capital approval. Only six (6) participants of the purposively selected sample of twenty (20) participants accepted the interview invite. Even though interviews were held with only six (6) participants from the sample selection of twenty (20), the researcher believed that there was sufficient data saturation as the participants were a diverse representation of the spectrum across the sample. The six participants comprised of members of the Gate Review, Investment Forum and Capital Investment Committee (CAPIC) approval committees at the Ports Authority. All respondents were considered subject matter experts within their fields. The questionnaires and interview transcripts for the qualitative research can be found in Appendix 1 and Appendix 2 respectively.

4.3.3 Data transcription

According to Saldana (2015:1-32) coding of transcripts in qualitative research summarises and captures the essence of the datum’s primary content. Transcription of the qualitative interviews proved challenging. Responses from some interviewees were almost twice as long as others with fewer coherent, direct responses. There were also differing opinions on organisation specific procedures. Intelligent verbatim transcription was used to translate recorded speech into text while editing out the fillers and repetitions that might have distracted from the content and accuracy of the interview (Jentner, El-Assady, and Keim, 2017:1-6). While transcribing using the intelligent verbatim style, the researcher transcribed what was said while leaving out fillers, repeated words, nonverbal communication and ambient sounds. The researcher also corrected grammatical errors and edited the transcript to improve content. Slang words, organisation specific abbreviations and terms were replaced with more standard versions. The transcripts were sent to the respondents to review and confirm that the content remained true to the accuracy and intent of the interview. Additionally, although the respondents were very much representative and acquainted with the strategic capital investment process, some opinions were vastly different from the historical evidence of organisational performance. The reasons for this could be attributed to the lack of formal implemented procedures and processes governing the capital investment process within the Ports Authority.

4.4 Coding and analysis of research themes

The research used simultaneous coding to code the data for analysis. As recommended by Saldana (2015:1-32). The transcripts were read by the researcher several times. Each time the researcher identified words, phrases, repetitions, similarities or peculiar statements within the transcripts that could be isolated as a summative, essence-capturing descriptive of the statement or intent of the research participant. The researcher continued in this vein through several iterations of reading through the transcripts and identifying similar codes on each read. The issues and concerns raised by the research participants were extracted from the transcripts as codes. Once these codes were listed, the researcher started to dissect, combine and categorize the codes to reflect similar themes. Table 4.1 illustrates the categorization of the codes used to organize and group data that shared similar characteristics or referred to the similar constructs, concepts, models and theories in the management of portfolios of projects within the corporate context. Drawing from the Six Sigma methodology recommended by Alexandra and Pinto (2014:912-920), a fishbone diagram was applied in determining the categories of the codes. The fish bone tool encouraged the researcher to identify categories based on root causes of the coding applied to the transcripts. The researcher thereafter systematically evaluated and analysed the codes in Table 4.1, by gathering data using the Six Sigma methodology to confirm the critical root causes of the problems identified in each of the categories. This analysis provided a deeper understanding of how the identified root causes directly contributed to capital underspend within the Ports Authority over the recent financial years. Lean Six Sigma comprises all the Lean and Six Sigma tools for waste elimination and reduction in defects by implementation of the DMAIC (define, measure, analyse, improve, control) model. The article by Tenera and Pinto (2014:912-920) successfully implemented a Lean Six Sigma (LSS) project management process improvement model in a real enterprise environment which had formal and established project management systems based on the PMBOK and the best practice standards for project management according to the PMI (Project Management Institute,2018). Hence following the Six Sigma approach recommended by Alexandra and Pinto (2014:912-920), the root causes were interpreted and critiqued to draw meaningful conclusions about the problems identified in the interviews.

Table 4.1: Categorization of the codes from interview transcripts

category	project selection criteria	best practices	investment decision making	key challenges
coding	Finance	Group 1	Group 1	Group 1
	capacity creation	processes	customer requirements	late delivery
	operational efficiency	standards	infrastructure failure	procurement delays
	safety	methodologies	emergency repairs	overspending
	regulatory, environmental compliance	audits	Group 2	underspending
	job creation, skills development	PLP	readiness of business case	incorrect estimates
	enterprise risk	Group 2	Group 3	Group 2
		project selection framework	corporate plan	ethics and poor governance
		strategy alignment		lack of competence
		selection criteria		Group 3
		prioritization		no compliance to processes and procedures
				Group 4
				lack of investor confidence

Based on the analysis of the coding of the interview transcripts in Table 4.1, the researcher was better positioned to link the codes and categories to themes consistent with the project selection framework as suggested by the interviewees or based on the researchers frame of reference. For instance, while the resource capacity and benefits realization were valid codes arising out of the transcripts, they were not directly related to the primary objective of

the research which was to develop a project selection model to support infrastructure investment programmes within the Ports Authority, South Africa. They were also not directly impactful to the sub-objectives of the research in identifying the project selection criteria or in aligning the project selection model to business success. The researcher therefore shortlisted the categories that were directly related to the research objectives through a process of elimination.

Table 4.2: Research relevant themes

Theme 1	project selection criteria	
Theme 2	best practices	
Theme 3	investment decision making	
Theme 4	key challenges	Procurement Delays
		Incorrect estimates
		Ethics and corporate governance

4.4.1 Theme 1: Project selection criteria

Participants were asked if they believed that projects were selected using objective selection criteria and their responses were similar for instance, *[Participant_1] For the most part. Projects are selected to sustain or improve capacity. However certain projects need a specialized criteria in order for them to be prioritized. [Participant_3] Personal preferences from higher management could lead to bias in project selection.* Hence the respondents seemed to agree on the need for objective project selection criteria in decision making to prioritise or defer capital investment projects. Respondents were also asked to state what they believed the barriers to providing objective project selection in the organization were. *[Participant_6] No. There is no robust ranking model that talks to our strategy and our objectives as Transnet or even if we were unregulated that talks to the countries roles, strategy and initiatives. [Participant_1] The legacy of how we used to do things has led to a rigid mind-set. We need to depart from this to embrace best practices.* Their responses were aligned in stating that project selection was a subjective process based on perceptions of individuals rather than the organizational requirements or strategic alignment.

As discussed in the Literature Review chapter, the key project selection criteria were aligned to the Department of Public Enterprises strategic objectives for State-owned Entities, the Transnet 4.0 strategic objectives of the Transnet SOC Ltd corporate office that were rolled down to each operating division such as the Ports Authority and the Ports Authority's National Ports Plan which included the Port Development Framework Plan for each port within South Africa (Department of Public Enterprises, 2019),(Transnet,2018),(National Ports Plan, 2019). In selecting the criteria for model development in state-owned entities such as the Ports Authority, it was necessary to identify the metrics most important in measuring project value both to shareholders as well as stakeholders where stakeholder value included value for employees, suppliers, customers, the local community and society at large. In her journal, Gosenheimer (2012:1-8) recommended that the first step was to define and agree on the corporate strategy and its priorities (e.g. short- term or long-term strategies; change in business environment etc.). The following criteria were established as a guide to effectively test for strategic fit:

- i. Demonstrate the strategic fit of the anticipated investment with respect to the need being addressed; the opportunity being leveraged or the target market; the risk being mitigated; the revenue/business being protected; the value to be added to the business

- ii. Align the project objectives to support the strategic objectives as set out by the MDS and the incoming Transnet 4.0 as well as the Port Strategy

The Transnet SOC Ltd infrastructure planning objectives were identified as operational efficiency, create capacity ahead of demand, safety and regulatory compliance, sustaining capital and expansion capital. The Ports Authority's primary objectives were identified as port infrastructure provision and development, efficient integrated port system, employee/ customer/stakeholder and job creation, Safety/Security and Regulatory compliance. These objectives were streamlined to eliminate redundancy and listed as project selection criteria on the qualitative semi-structured questionnaire. The respondents were asked to rank the criteria in order of importance within the context of the Ports Authority using an ordinal scale of 1-10 where 1 was the most important and 10 was the least important. The project selection criteria listed in Table 4.1 were all ranked by the research participants as listed in order of priority based on the ratings. The process flow in Figure 4.8 was developed in consultation with the Ports Authority Enterprise Portfolio Management Office (EPMO) to guide the screening of projects in the test for strategic fit.

4.4.2 Theme 2: Best practices

The codes for this section of the transcripts were clustered under the category 'best practices' and sub-grouped for convenience of analysis. In this section of the interview, the respondents provided arguments for their understanding of reasons that the existing method of project selection was not aligned to best practice. All six respondents unequivocally agreed that the organization does not follow best practice in project selection. When respondents were asked what the current process of selecting projects for the corporate plan in the organization was, their responses indicated that there was no project selection process aligned with best practice **[Participant_2]** *As far as I'm aware there's no set process. The team decides what they want to do and then they add it onto the corporate plan.* **[Participant_3]** *Project selection may not be an issue but readiness and prioritization may be an issue. Currently although projects had been selected we were unable to begin as we were not ready and uncertain of which project needed more of our focus.* **[Participant_4]** *I'm not aware of any specific process being used on the corporate plan. EPMO has a process to rate projects in the model but the process to input the data and the application of this data is not effective or, in my opinion, used.* Respondents were asked if, in their opinion, the manner of selecting and deferring projects in the organization aligned with best practices of other SOEs in the port environment and their responses indicated the negative. **[Participant_6]** *The current process is very haphazard. We are not aligning ourselves to best practice in terms of what's happening in the international space.* Respondents suggested the implementation of a project selection model aligned with best practice. **[Participant_3]** *We are not using best practice to select projects. We need to implement a best practice model to get things done.* **[Participant_4]** *A prioritization tool should be used. The selection of our projects needs to align with the NDP and other governmental policies but also with our core values as an organization.* **[Participant_6]** *A robust ranking model with good criteria for project selection, the firmed up organisational strategy of where you want to be, using good methodologies. We have somehow standardised our methodologies but to implement those methodologies you need the right skills and tools. So these are some of things we need to get right and out processes aligned to project delivery as well. The PPM, the internal processes and policies that we have must be aligned to foster and ensure that we improve project selection and help us in the right direction. also the PDFP plays a big role as I mentioned earlier understand the business need of the port within its environment and how it serves the hinterland and surrounding communities so we know that we are doing projects to enhance that hinterland and develop the community as well.* Respondents

repeatedly mentioned that there was no application and alignment with processes, procedures, methodologies and standards provided by Transnet SOC Ltd. *[Participant_6] There are pockets of good processes but it is a matter of pulling all these things together and looking at it objectively to say that if this is the foundation what we are setting and if this foundation is robust enough then project selection becomes easier to facilitate but if we remain with this fragmented approach and pockets sitting everywhere else, we are not going to get it right.* Although respondents acknowledged that the processes and procedures were available on the Transnet SharePoint directory, they believed that there was no monitoring and control to ensure that these were applied consistently within the project environment (Transnet, 2018). *[Participant_2] Firstly, we need to review and implement our processes which would resolve our bottlenecks. [Participant_6] We have somehow standardised our methodologies but to implement those methodologies you need the right skills and tools. The PPM, the internal processes and policies that we have must be aligned to foster and ensure that we improve project selection and help us in the right direction. also the PDFP plays a big role as I mentioned earlier understand the business need of the port within its environment and how it serves the hinterland and surrounding communities so we know that we are doing projects to enhance that hinterland and develop the community as well.* Respondents also mentioned the merits of the Project Lifecycle Procedures citing reasons for non-compliance as the lack of audits and post implementation reviews to ensure that due diligence and governance was consistently applied with accountability (Mahomedy, 2016:1-26). Respondents believed that compliance with the Project Lifecycle Processes and the Transnet SOC Ltd procedures were not enforced for compliance within the Ports Authority (Cheshmberah, Makui, Seyedhoseini, Yousefi, 2011: 216-226). Project benefits realisation post implementation, part of the PLP, was recommended to ensure that the projects achieved their objectives as outlined in the approved business cases for capital investment. According to respondents, compliance with processes, standards and methodologies, already prescribed by Transnet SOC Ltd within Ports Authority, would guide performance monitoring and compliance with best practice for project selection.

To review the impact that the lack of project selection and ranking had on the annual corporate plan, the researcher gathered data on a monthly basis over twelve months beginning from May 2018 to establish the number of projects that were either:

- i. Budgeted on the corporate plan but deferred to the next financial year or deferred to subsequent financial years.
- ii. Projects selected on the corporate plan and then deferred or cancelled
- iii. Projects ranked as a 'priority' on the corporate plan and not executed

Table 4.3: Analysis of data to determine the relationship between delayed start and project selection

project No.	Project Name	delayed start (months)	Project Selection
1	not disclosed due to confidentiality	38	NO
2	not disclosed due to confidentiality	27	NO
3	not disclosed due to confidentiality	37	NO
4	not disclosed due to confidentiality	24	NO
5	not disclosed due to confidentiality	24	NO
6	not disclosed due to confidentiality	24	NO
7	not disclosed due to confidentiality	61	NO
8	not disclosed due to confidentiality	91	NO
9	not disclosed due to confidentiality	59	NO
10	not disclosed due to confidentiality	97	NO
11	not disclosed due to confidentiality	37	NO
12	not disclosed due to confidentiality	37	NO
13	not disclosed due to confidentiality	24	NO
14	not disclosed due to confidentiality	0	YES
15	not disclosed due to confidentiality	12	NO
16	not disclosed due to confidentiality	85	NO
17	not disclosed due to confidentiality	51	NO
18	not disclosed due to confidentiality	55	NO
19	not disclosed due to confidentiality	66	NO
20	not disclosed due to confidentiality	0	YES
21	not disclosed due to confidentiality	0	YES
22	not disclosed due to confidentiality	50	NO
23	not disclosed due to confidentiality	37	NO
24	not disclosed due to confidentiality	50	NO
25	not disclosed due to confidentiality	6	YES
26	not disclosed due to confidentiality	54	NO
27	not disclosed due to confidentiality	12	NO
28	not disclosed due to confidentiality	0	YES
29	not disclosed due to confidentiality	12	NO
30	not disclosed due to confidentiality	0	YES
31	not disclosed due to confidentiality	42	NO
32	not disclosed due to confidentiality	63	NO
33	not disclosed due to confidentiality	12	NO

Based on the graphical analysis in Figure 4.1 of the data from table 4.3, there was no significant relationship between delayed start and the project not being selected in the optimized corporate plan. There was no correlation between the means. Further analysis was required to determine if project selection had a positive relationship with delays in project start. The statistical analysis showed a significant relationship between delayed start and project selection. There was correlation between the means. Therefore poor project selection was identified as a root cause of project delayed start.

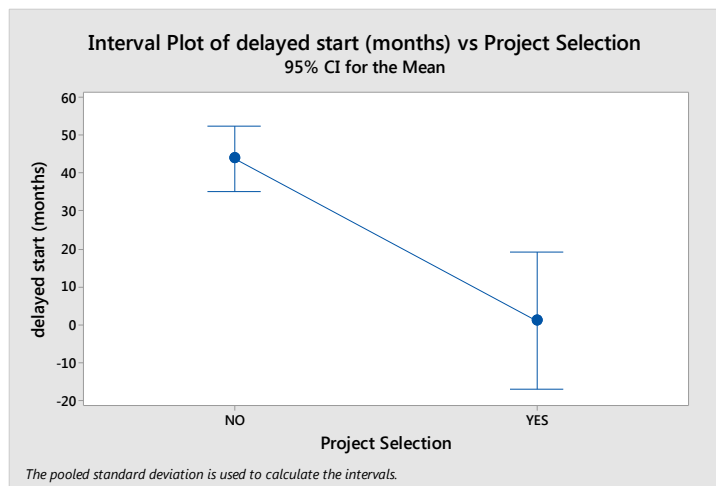
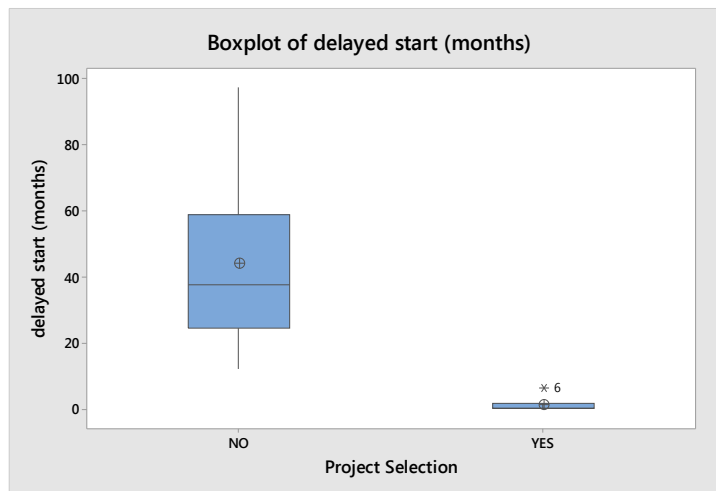


Figure 4.1: Graphical and Statistical Analysis to determine if project selection is a root cause to the delayed start of the project

Similar analysis was done to examine the relationship between project deferral and delayed start. Based on the graphical analysis R sq. was less than 70% hence there was no significant relationship between delayed start and project deferral. Therefore project deferral was not indicated as a root cause for the delayed start of projects. Based on the graphical analysis of data comparing delayed start and project ranking, R sq. was less than 70% hence there was no significant relationship between delayed start and project ranking. Therefore project ranking was not indicated as a root cause for the delayed start of projects. Many of the issues and concerns, raised by respondents, were identified as the key challenges and top risks underpinned in the Corporate Plan of the Ports Authority financial year 2019 and 2020 as shown in Figure 4.2 (Transnet, 2019).

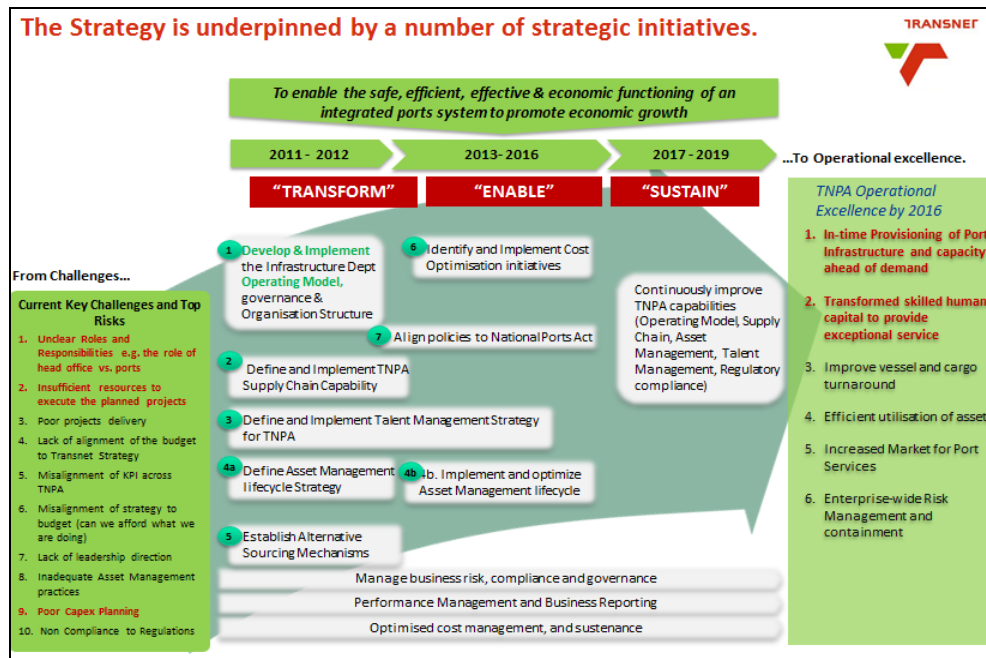


Figure 4.2: The Strategic Initiatives for the Ports Authority [Source: Transnet Corporate Plan FY 2019/2020]

4.4.3 Theme 3: Investment decision making

Under the category for investment decision making, respondents described the processes that were followed by the Ports Authority in selecting projects for capital investment as “subjective” and “lazy”. They identified the Ports Authority as a “catalyst for economic growth” and were very aware of the importance of project selection on infrastructure investment and growth for South Africa. **[Participant_1]** *It is through infrastructure development that our economy is stimulated. The construction industry results in job creation which influences the macro-economy and technology sectors. It is only through state-owned companies that a pronounced impact can be seen.* **[Participant_2]** *The Ports Authority is not seen as a catalyst for economic growth. We should be the heartbeat of the economy but we fall flat as we fail at economic growth and job creation.* **[Participant_6]** *The current manner in which we select or defer projects is largely based on funding. Whether you have the funds or not. Internally we are held to ransom in that we have to ensure that projects that have already been contracted remain viable and funding needs to be set aside for those projects. Whether those projects are actually going to achieve the business need is not looked at. Because these projects are contracted, we are unable to pull the plug on these projects so we need to go ahead with projects simply because they are contracted. We don't look at other criteria, we don't look at other practices that could be implemented to ensure that we defer projects or we select projects in the right manner. Currently projects are being deferred if they do have business cases ready in time for funding allocation. This is a lazy approach because you could be deferring projects that would benefit the organisation strategy but purely because of our lack of readiness and preparedness, we lose opportunities.* The majority of projects were selected based on customer requirements e.g. deepening of the berths at the Port of Durban to accommodate larger cargo vessels, building tank farms to create capacity or infilling land into the sea to expand the berthing capacity for container handling. There were also a considerable percentage of projects that applied for capital funding as a result of infrastructure failure owing to neglected maintenance. **[Participant_6]** *The bulk of capital projects is more on refurbishment and capitalised maintenance because we have not been serious about doing our maintenance*

properly. We are not spending the capital that we should be investing to create new assets for growth, stimulation of the economy etc. TNPAs investment plan is very top heavy on maintenance projects, a 60/ 40 split between maintenance and new business investment. Fixing this means that we need to look at projects that will drive Transnet's objectives to new business growth and facilitating that growth in the economy and obviously changing our approach to maintenance. While these type of projects should typically be funded out of the planned maintenance budgets, they necessitated capital investment due to poor maintenance budget planning, lack of proper planned maintenance strategies and/or oversights in annual inspections. These type of projects created emergencies/ unforeseen priority on the corporate plan and were prioritized by default due to the nature of urgency or emergency repairs rendering the port inoperable. The capital investment approval process required lengthy applications for corporate governance before funding was approved. This resultant delays directly impacted operating income, port tariffs, infrastructure availability and service continuity to customers (Meyiwa and Chasomeris: 2016:1-20). Emergency repairs and maintenance related projects also created an automatic prioritization of capital meaning that capital budgeted for other capacity creation, safety related or environmentally regulated projects were deferred as a result (Transnet, 2019). This practice was aligned with research conducted by Ndlozi (2016: 1-87), proving that South African ports currently have suboptimal capacity, aged and unreliable infrastructure and diminishing skills. In an online article (Moneyweb, 2017) the Minister of Finance, South Africa, tasked the office of the South African presidency to look at ways to cut expenditure worth about R25 billion and to identify “revenue-enhancing measures”, which should generate approximately R15 billion. Ndlozi (2016: 1-87) also stated that South Africa is challenged by its exorbitant port tariffs and increasing foreign debt used to fund port infrastructure. The impact of funding maintenance projects out of capital investment funds reduced the available capital funding for capacity creation projects demanded by the Ports Authority’s stakeholders. The Ports Authority was therefore challenged to justify the annual tariff application as per the Record of Decision issued by the Ports Regulator South Africa (2019). For the financial year 2019/ 2020, the National Ports Authority applied, to the Ports Regulator South Africa, for a tariff based on infrastructure investment of R 4.5 billion (Ports Regulator South Africa, 2019), (Fakir:2018:1-58). The corporate plan indicated that the Ports Authority would only spend R 2.7 billion, already planning to underspend by R1.8 billion (Transnet, 2019). This translated into a gross over recovery on the tariff received by the Ports Authority based on the service offering promised to stakeholders. The reality is that this snapshot was indicative of a trend in preceding financial years to only achieve approximately 30% of the target investment (Transnet, 2019). Besides the ethical considerations of over-charging and under-delivering, the Ports Authority has an accountability as a state-owned entity to unlock economic growth within South Africa. Failing to perform has crippling consequences to the country’s economy (Meyiwa and Chasomeris: 2016:1-20), (Ndlozi: 2016: 1-87), (Gordhan: 2017:1-32) (Fakir: 2018: 1-58).

Another driver for capital investment was cited, by respondents, as the readiness of the business case. **[Participant_1]** *The current method is preparedness or lack of preparedness of business cases regardless of the strategic intent. If it has been earmarked the project is either executed or deferred.* Irrespective of the strategic importance of the project or the interdependencies with other strategic projects, project teams were selecting quick wins and easy business cases to reserve capital funding. The objective was to demonstrate performance by the number of business cases that could be approved irrespective of the lack of prioritization or strategic alignment. This process allowed room for subjectivity and ethical misconduct in prioritizing projects for capital funding. The

respondents recognised that the corporate plan was currently used as a project selection framework even though the corporate plan was intended as a purely financial performance tracker (Transnet, 2019). *[Participant_6] The current process is very haphazard. We are not aligning ourselves to best practice in terms of what's happening in the international space. Each port develops an investment plan or corporate plan for their port and that gets rolled up into TNPA's corporate plan. Although there is a ranking model of sorts, that ranking model is not robust enough to decide if these are the projects to help us develop our economy or facilitate trade within our country. Each port should have an investment plan talking to the growth initiatives in that particular sector and understand what projects need to be undertaken to facilitate that growth and improvement within that sector.* Decisions were taken, subjectively at a port level, on projects they intended to execute in any financial year and these projects were then added onto the corporate plan. The only criteria for project selection was purely financial modelling. In instances where projects were driven by safety regulations or environmental compliance, for instance, no financial modelling criteria was required to justify the project selection. Respondents recommended the process for strategic fit as explained in Figure 4.3 where projects were required to align with Transnet objectives and with the Ports Authority's objectives. If projects had no strategic alignment, it was recommended that projects be deferred or cancelled. This recommendation was consistent with the guidance by Gosenheimer (2012: 1-8) and Steward (2016:23-33).

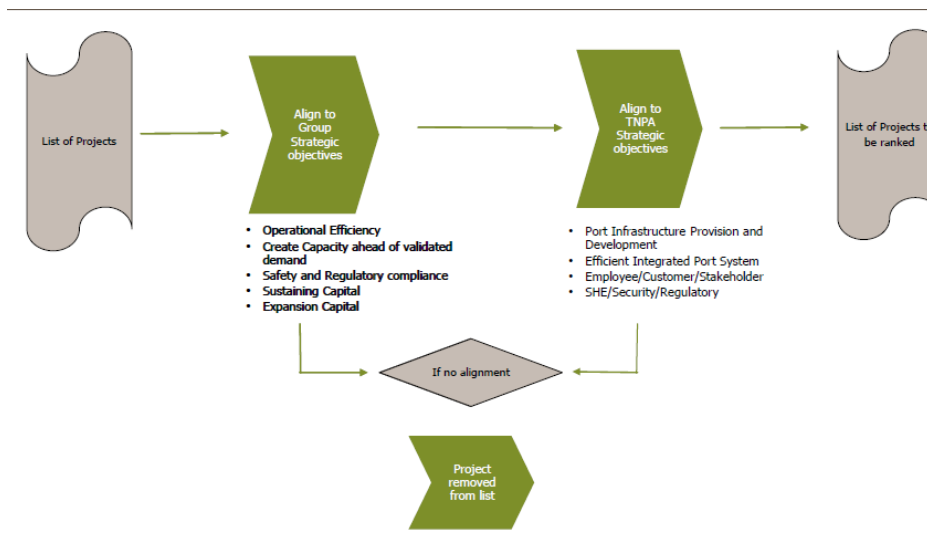


Figure 4.3: Process flow for strategic alignment in project selection

4.4.4 Theme 4: Key challenges

There were several items discussed under the key challenges, experienced with project selection for capital investment, as the respondents were well versed and experienced with the subject.

4.4.4.1 Procurement delays

Respondents cited the key reasons for delays in projects as being lengthy processes and procedures and delays in sourcing of funds to appoint contractors. *[Participant_3] DPE has questioned impact of searching for sourcing of funds for projects leading to delays. Delays in projects have been linked to KZN's low GDP and a lack of job creation. Since a single project can lead to so many delays, multiple projects amplify this effect. [Participant_5] Historically, Transnet built a lot of infrastructure that did not have a large return on investments. Since then we have adopted the PLP process that outlines the project's plan from conception to full execution showing the feasibility of the project. So although the project takes a long time it will, theoretically, contribute the most revenue and alleviate poverty. As a government organization we are audited quite often and have to follow PFMA, We must show that we*

are contributing to the fruits of the nation and churn our economy. We do take a long time but that is because we follow an arduous process to ensure we deliver on our investments. The Transnet approval process takes a long time, in terms of governance process.

In the budget speech, as a precursor to the presidential State of the Nations Address in 2019, the Minister of Finance, Mr Tito Mboweni, emphasized the need for radical socio-economic transformation by stating that the infrastructure fund was the central pillar for reprioritization of the national budget. His recommendation was to promote involvement of the private sector and development finance institutions to catalyze R 526 billion worth of project spending of which the state-owned entities alone would be responsible for over R100 billion in the next decade (Mboweni: 2019:1-20). Maseko (2014:1-14) stated that infrastructural development was a governmental responsibility since efficient execution of infrastructure projects contributed directly and indirectly to economic and social development. He recognised however that governments, both in developed as well as developing nations, were increasingly faced with constraints in delivering on their infrastructure mandate and responsibility. He recommended that proper planning take place before committing to projects in order to avoid project delays due to lack of funding. In contrast to Mboweni (2019:1-20), Maseko (2014:1-14) emphasised that the public – private partnerships were not the silver bullet to remedy procurement delays in infrastructure development. South Africa was historically guilty of a lack of investment in infrastructure, skills and development in capability. Several government initiatives had been developed over the years to address these challenges. In particular, the New Growth Path (NGP) developed in 2010, which aligned and built on previous policies to ensure the achievement of government's development initiatives for South Africa (Department of Transport: 2017:1-12), (Department of Public Enterprises: 2019:1-36), (Volden: 2019:1-21). Transnet fully endorsed and supported the Government's New Growth Path policy, the National Development Plan (NDP) and Operation Phakisa through its facilitation of Supplier Development initiatives. The procurement team within the Ports Authority applied the supplier development and local content initiatives in both the tender process and the award of contracts for and on behalf of the Employer in efforts to curb the effects of past inefficiencies. Transnet uses the Construction Procurement Manual (CPM) (Transnet: 2020:1-77) in incorporating procedures for general procurement and construction procurement for integrated supply chain management. The CPM is very prescriptive with respect to the preferential procurement approach, supplier development, local content, bid evaluation criteria etc. It is often the case within the Ports Authority that the policies and procedures put in place to govern its procurement deliverables have become the greatest obstacle to delivery. A situational analysis workshop within the Ports Authority focused on reasons for poor delivery by procurement departments and revealed the following:

➤ Skills and Skills Transfer

Over the past few years a number of well experienced employees had left the organization through natural attrition (retirement) and resignations to seek opportunities in other organisations and or countries. This left a gap in the middle range career for employees that had sufficient experience to transfer skills to the young and newly appointed staff. The original managing contract used within the Ports Authority was geared towards private sector consulting and construction expertise being leveraged to solve the issues with skills transfer. This approach proved unsuccessful as the outcomes were limited because employees were seconded to the Managing Contractor (MC) for a week at a time due to staff constraints within the Port Engineers Department. The average time for engineering and project management staff to register with the appropriate professional bodies was in the region of 3 to five years. The

requirements for registration included an appropriate level of experience in various disciplines including design, construction supervision and project management, as examples. The MC's brought some relief and assisted with the delivery of projects since 2012 but there was an overreliance on the MC's because the expectation that the junior engineers would be able to undertake design at the appropriate level did not materialize as planned. The second reason for the overreliance on the MC's was the efficiency at which the MC's were able to produce the designs and contract documentation required for the tender process. In some cases the MC was utilized to develop concepts, where the internal staff claimed they did not have the expertise in-house. The Ports Authority's Chief Engineer was in the process of developing a dedicated design center to undertake design works for minor works which did not require sophisticated design tools and or concepts. The design center was still in its infancy but there were plans in place to increase the design center staff in the near future. The MC Contract was developed and concluded with a monetary cap which meant that once the initial monetary value of the contract was reached no more work could be awarded to the MC under the contract. To mitigate the risk of non-delivery a number of projects that were initially to be awarded to the MC's were redirected to Transnet Capital Projects, a division of Transnet SOC Ltd, who had the resources to undertake the required projects.

➤ Transnet Group Capital as an EPCm Contractor

Transnet Group Capital (TGC) contracted to the Ports Authority as an Engineering, Procurement and Construction Management (EPCm) contractor, under a Project Specific Agreement (PSA). The PSA was an internal agreement used to define the terms and conditions for the works to be undertaken. The lack of skills within the Ports Authority resulted in heavy reliance on the services of external consultants for design and project management to close the skills gap. The procurement department of TGC was project focused and had the processes and the skills to undertake procurement for projects on schedule and within budget. While the Ports Authority was in the process of capacitating and empowering its internal procurement department for dedicated capital project procurement, the Ports Authority remained at risk of not meeting contractual deadlines for the majority of projects listed on the corporate plan (Transnet, 2019).

➤ PMO sustainability

In order to competitively position the Project Management Office (PMO) and the Engineering office within the Ports Authority, operating models were being reviewed that would create centres of excellence capable of supporting the growth and the sustainability of the Ports Authority into the future. To ensure that the Ports Authority, as the asset owner, remained the expert on management, design and maintenance of port related infrastructure, there was to be a centralized repository of specifications and standards to ensure consistency across the organisation. The reliance on external consultants and contractors hampered the development of standards and specifications because each design company had its own in-house intellectual property that could not be shared with outside parties.

To verify the impact that procurement delays had on the delayed start of projects and the subsequent impact on the annual corporate plan budget forecasts, the researcher gathered data on a monthly basis beginning from May 2018 and ending May 2019 to establish the number of projects that were sanctioned (approved for funding) but not contracted to spend. From the data analysed in Table 4.4, a total of 9 out of 34 projects ie.26.5% of projects were sanctioned but not contracted.

Table 4.4: Data to determine the relationship between procurement delays and delayed project start

#	Project Name	BC Status	SCM Status	Procurement delays	delayed start (months)
1	not disclosed due to confidentiality	Sanctioned	Contracted	no	38
2	not disclosed due to confidentiality	Sanctioned	Contracted	no	27
3	not disclosed due to confidentiality	Not Sanctioned	Not Started	no	37
4	not disclosed due to confidentiality	Sanctioned	Contracted	no	24
5	not disclosed due to confidentiality	Sanctioned	Contracted	no	24
6	not disclosed due to confidentiality	Sanctioned	Contracted	no	24
7	not disclosed due to confidentiality	Sanctioned	not contracted	yes	61
8	not disclosed due to confidentiality	Sanctioned	Contracted	no	91
9	not disclosed due to confidentiality	Sanctioned	not contracted	yes	59
10	not disclosed due to confidentiality	Sanctioned	Contracted	no	97
11	not disclosed due to confidentiality	Sanctioned	Evaluated	yes	37
12	not disclosed due to confidentiality	Not Sanctioned	Not Started	no	37
13	not disclosed due to confidentiality	Sanctioned	Out on Tender	yes	24
14	not disclosed due to confidentiality	Sanctioned	Contracted	no	0
15	not disclosed due to confidentiality	Sanctioned	Evaluated	yes	12
16	not disclosed due to confidentiality	Sanctioned	not contracted	yes	85
17	not disclosed due to confidentiality	Sanctioned	Contracted	no	51
18	not disclosed due to confidentiality	Sanctioned	not contracted	yes	55
19	not disclosed due to confidentiality	Sanctioned	Contracted	no	66
20	not disclosed due to confidentiality	Not Sanctioned	Not Started	no	0
21	not disclosed due to confidentiality	Sanctioned	not contracted	yes	0
22	not disclosed due to confidentiality	Not Sanctioned	Not Started	no	50
23	not disclosed due to confidentiality	Sanctioned	Contracted	no	37
24	not disclosed due to confidentiality	Sanctioned	Contracted	no	50
25	not disclosed due to confidentiality	Not Sanctioned	not contracted	no	6
26	not disclosed due to confidentiality	Not Sanctioned	Not Started	no	54
27	not disclosed due to confidentiality	Not Sanctioned	Not Started	no	12
28	not disclosed due to confidentiality	Sanctioned	Contracted	no	0
29	not disclosed due to confidentiality	Not Sanctioned	Not Started	no	12
30	not disclosed due to confidentiality	Not Sanctioned	Not Started	no	0
31	not disclosed due to confidentiality	Sanctioned	Contracted	no	42
32	not disclosed due to confidentiality	Sanctioned	Contracted	no	63
33	not disclosed due to confidentiality	Sanctioned	not contracted	yes	12

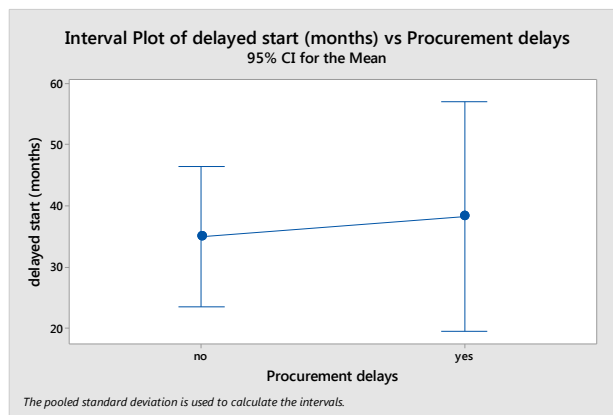
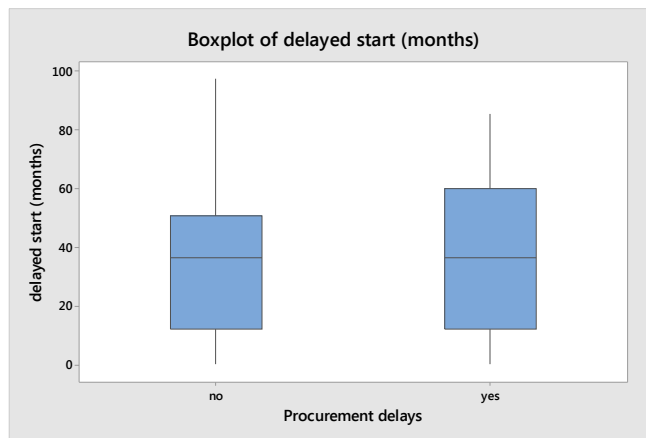


Figure 4.4: Graphical and Statistical analysis for procurement delays

Based on the graphical analysis using the Minitab software for Lean Six Sigma analysis in Figure 4.4, there is no significant relationship between procurement delays and delayed start of projects. Projects with procurement delays had a bigger range while projects with no procurement delays had more outliers. There was no correlation between the means. Further statistical analysis indicated no significant relationship between delayed start and procurement delays. There was no correlation between the means. Therefore procurement delays was not indicated as a root cause for delayed start of projects and subsequent capital underspend. Since the statistical findings did not correlate with the theoretical or empirical findings the reasons for the statistical finding could be that the procurement process did not contribute to the critical path on the project schedules or it could be as a result of incorrect reporting by project teams. Since procurement delays have in some instances been as long as eighteen months (as evidenced by the project progress reports) and directly impacted project progress, the assumption leans strongly towards incorrect reporting by project teams.

4.4.4.2 Incorrect estimates

When respondents were asked their opinion for the reasons that the Ports Regulator South Africa rejected the organization's first tariff application in 2017 they cited poor project performance. Delays on schedule and over or under expenditure of budgets were given as the leading reasons for project failure.

Fraser and Notteboom (2016: 53-54) reviewed developing countries, such as South Africa, that were facing many constraints in securing the right funding sources to develop infrastructure within the ports given the more pressing social and national infrastructural priorities. Hence the accuracy of project estimates, and the prioritization of infrastructure projects, to secure public funding became critical to securing funding for the success of projects. On the 1 July 2016 a new standard was issued in terms of section 76(4) (c) of the Public Finance Management Act, 1 of 1999, which allowed the National Treasury to issue “regulations or instructions for the determination of a framework for an appropriate procurement and provisioning system which is fair, equitable, transparent, competitive and cost-effective” (Swart and Swanepoel: 2019:1-11). The implications of this standard, apart from others, meant that public entities, such as Transnet, would need to apply for condonation at National Treasury level when project budgets were exceeded and project estimates increased. This additional governance step placed a further burden on project delivery in terms of astute schedule and cost management. **[Participant_1]** *Poor past performances by CAPEX. Incorrect estimates were given as the leading reason for project failure leading to the rejected port tariff application in 2017.* **[Participant_3]** *Because tariff applications are based on the premise that we will deliver on the promised infrastructure and historically we have the trend of not delivering. So we receive the money but don’t deliver to support what we charge.* **[Participant_5]** *We have an asset base of about 25 billion but because of our rigorous processes we are not spending the committed funds on infrastructure each financial year. Cross subsidization of other Transnet operating divisions also diluted return on investment to stakeholders.* **[Participant_2]** *We don’t do the things we indicated we would such as delivering services, infrastructure or job creation. We’re not stimulating the economy yet we receive benefits without giving back.* **[Participant_6]** *The other reason is that TNPA's profits are diluted within the bigger scheme of Transnet and the cross subsidization of funding is probably one of the reasons why the regulator has rejected the tariff application.*

To review the impact of incorrect project estimates on the underspend of capital investment on the annual corporate plan, the researcher gathered data on a monthly basis beginning from May 2018 to establish the variance between project budgets and actuals between the -10% and +10% variance margin. From the data in Table 4.5, 10 out of 33 i.e. 30% of projects were not delayed due to the incorrect estimate while 23 out of 33 i.e. 70% of projects were delayed due to an incorrect estimate.

Table 4.5: Variance between project budgets and actuals between -10% and 10%

Comparison.	Name of Project	Var %
Variance in CAPEX > 10%	not disclosed due to confidentiality	100%
	not disclosed due to confidentiality	100%
	not disclosed due to confidentiality	100%
	not disclosed due to confidentiality	100%
	not disclosed due to confidentiality	100%
	not disclosed due to confidentiality	100%
	not disclosed due to confidentiality	100%
	not disclosed due to confidentiality	100%
	not disclosed due to confidentiality	100%
	not disclosed due to confidentiality	100%

Variance in CAPEX < 10%	not disclosed due to confidentiality	100%
	not disclosed due to confidentiality	100%
	not disclosed due to confidentiality	96%
	not disclosed due to confidentiality	82%
	not disclosed due to confidentiality	55%
	not disclosed due to confidentiality	51%
	not disclosed due to confidentiality	42%
	not disclosed due to confidentiality	39%
	not disclosed due to confidentiality	28%
	not disclosed due to confidentiality	-12%
	not disclosed due to confidentiality	-35%
	not disclosed due to confidentiality	-48%
	not disclosed due to confidentiality	0%
	not disclosed due to confidentiality	0%
	not disclosed due to confidentiality	0%
	not disclosed due to confidentiality	0%
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	not disclosed due to confidentiality	0%
	not disclosed due to confidentiality	0%
	not disclosed due to confidentiality	0%

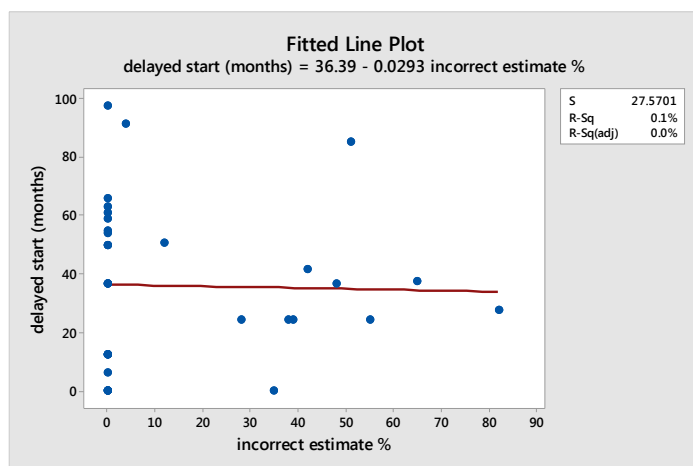


Figure 4.5: Graphical analysis of the relationship between incorrect estimate and delayed project start

Based on the graphical analysis in Figure 4.5, R sq. is less than 70% hence there is no significant relationship between delayed start and incorrect estimate. Therefore incorrect estimate was not indicated as a root cause to delayed start in cash flows. It is important to note that this result does not dilute the importance of correct estimating

and efficient cost management on projects. While there could be underlying reasons for the data misguiding the statistical analysis such as incorrect reporting, cross subsidization of projects, budget shifts across project phases etc., the key challenge of incorrect estimates provided by respondents through the qualitative interviews does not hold significant bearing on the project success and therefore the business success based on the analysis.

4.4.4.3 Ethics and corporate governance

Respondents were of the opinion that the lack of defined project selection processes aligned with best practice created barriers to ethics and corporate governance. *[Participant_2] There's no holistic view of the business. People have a silo mentality which leads to poor co-operation and a lack of streamlining. [Participant_4] People are prioritizing projects they want to be done rather than prioritizing projects that could be beneficial to the organization. [Participant_6] There's also some bias where projects are undertaken as pet projects that could be linked to political appointments or other agendas. Are we spending funding on the right projects that is independent of other agendas be it political agendas, self-enrichment aspirations etc. [Participant_6] Although Transnet's financial performance has been good, governance issues especially around the tenders etc. is dampening investor confidence. The lack of thinking outside the box as well. If you want to be world-class you have to think differently. Investors are also losing confidence because we haven't proven to be beyond reproach when it comes to governance. It seems that Transnet has been in a negative light with state capture and the principles that have been implicated thereof. So these impact on shareholder confidence and investor confidence in terms of securing capital but also getting right resources and good skills. Who wants to be associated with a company that is tainted? You are not going to attract world class people that would actually want to work in the organisation. It has a double edged sword approach. Good governance based on transparency is recommended to weed out corruption particularly within the ambits of procurement and contracts (Nimrod, 2015:1-237). The subject of ethics and corporate governance had been featured on many platforms owing to the dubious behaviour of public domains in the past decade. The OECD-Southern Africa Network on the Governance of SOEs was developed with the aim of improving the corporate governance of State-owned Entities (OECD, 2014:1-33). After unsuccessful attempts at privatisation and structural reform programmes in the 1990s, the theory was that, if governed properly, SOEs could support the national development of South Africa. The primary challenges with this initiative appeared to be the poor managerial and technical capabilities of participating SOEs. [Participant_1] We are ill-equipped with the correct resources as workers display low levels of competency and maturity. Some processes are inefficient and need to be re-visited as they prolong execution of projects. A more agile approach is needed. [Participant_2] We need to ensure our resources are adequately skilled. [Participant_3] Very rarely do we deliver on time and within budget. Poor project selection and a lack of adequate and competent resources effects our delivery. [Participant_1] Project metrics show constant late delivery as well as chronic overspending or underspending. Further irregular practices such as conflicts of interest and outright corruption had motivated the need for efficiency, competitiveness and commercial viability of existing SOEs. For South Africa, the King Commission on Corporate Governance was developed and subsequently modified for State-Owned Entities and had, to some extent, improved corporate governance in South Africa since 1994 (Nimrod, 2015:1-237). Many issues of concern remained with respect to corporate culture in the context of South African capitalism. Findings from the online article by Mpinganjira and Roberts-Lombard (2016:1-20), reflect that state-owned companies in particular have been slow to adjust to the merits of governance and ethics in fast tracking decisions to actualize sound corporate governance practices in order to deliver shareholder value. The*

most prevalent mechanism to control ethical conduct in SOEs was found to be ethical audits and training of staff. According to Nimrod (2015:1-237), the environment within SOEs remains in distress as boards and management struggle to maintain a balance between legislative compliance and performance. This study focused on governance structures within parastatals such as the Ports Authority in the context of improving decision making for infrastructure development. To review the impact that the governance processes had on the annual corporate plan, the researcher gathered data on a monthly basis beginning from May 2018 and ending May 2019, for all capital investment projects at the Port of Durban, Ports Authority, to establish the number of projects that passed the governance approval processes on the first attempt. Table 4.6 shows the variance between the planned and actual start of cash flow. It is evident from this data that almost every project was impacted by delays experienced in gaining approval for project capital investment funding through the governance processes that included the gate reviews, investment forums and capital investment committees.

Table 4.6: Governance approval in the first attempt

Project no.	Name of Project	Governance approval in first attempt	PROJECT START OF CASHFLOW		
			Planned	Latest Estimate	Variance (months)
1	not disclosed for confidentiality	NO	Apr-15	May-18	38
2	not disclosed for confidentiality	NO	Jan-10	Apr-12	27
3	not disclosed for confidentiality	NO	Apr-15	Apr-18	37
4	not disclosed for confidentiality	NO	Apr-11	Apr-13	24
5	not disclosed for confidentiality	NO	Apr-11	Apr-13	24
6	not disclosed for confidentiality	NO	Sep-11	Sep-13	24
7	not disclosed for confidentiality	NO	Apr-15	Apr-20	61
8	not disclosed for confidentiality	NO	Oct-12	Apr-20	91
9	not disclosed for confidentiality	NO	Apr-14	Feb-19	59
10	not disclosed for confidentiality	NO	Oct-12	Oct-20	97
11	not disclosed for confidentiality	NO	Apr-16	Apr-19	37
12	not disclosed for confidentiality	NO	Apr-16	Apr-19	37
13	not disclosed for confidentiality	NO	Apr-17	Apr-19	24
14	not disclosed for confidentiality	YES	Apr-16	Apr-16	0
15	not disclosed for confidentiality	NO	Apr-16	Apr-17	12
16	not disclosed for confidentiality	NO	Apr-13	Apr-20	85
17	not disclosed for confidentiality	NO	Apr-15	Jun-19	51
18	not disclosed for confidentiality	NO	Apr-15	Oct-19	55
19	not disclosed for confidentiality	NO	May-13	Oct-18	66
20	not disclosed for confidentiality	YES	Apr-19	Apr-19	0
21	not disclosed for confidentiality	YES	Apr-19	Apr-19	0
22	not disclosed for confidentiality	NO	Mar-16	Apr-20	50
23	not disclosed for confidentiality	NO	Sep-14	Sep-17	37
24	not disclosed for confidentiality	NO	Mar-15	Apr-19	50
25	not disclosed for confidentiality	YES	Apr-17	Oct-17	6
26	not disclosed for confidentiality	NO	Nov-15	Apr-20	54
27	not disclosed for confidentiality	NO	May-18	May-19	12
28	not disclosed for confidentiality	YES	Apr-19	Apr-19	0
29	not disclosed for confidentiality	NO	Apr-19	Apr-20	12

30	not disclosed for confidentiality	YES	Apr-17	Apr-17	0
31	not disclosed for confidentiality	NO	Apr-16	Sep-19	42
32	not disclosed for confidentiality	NO	Apr-15	Jun-20	63
33	not disclosed for confidentiality	NO	Apr-18	Apr-19	12

TOTAL NO. OF PROJECTS FOR PORT OF DBN 33

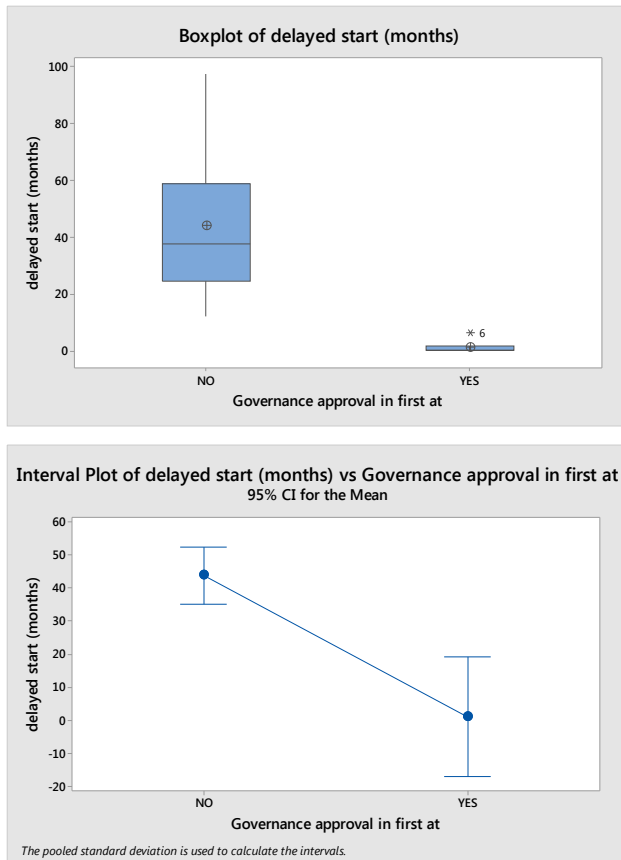


Figure 4.6: The graphical and statistical analysis for the governance process approval as a root cause to delayed start of projects

A graphical analysis of the delayed start in project cash flow illustrated in Figure 4.6 indicated no significant relationship between delayed start and governance approval in the first attempt. However, it seemed that there was a greater standard deviation on projects that do not get governance approval in the first attempt. There also appeared to be a greater delay in the project when there was no governance approval in the first attempt. There was no correlation between the means. Further statistical analysis was performed by the researcher using the Minitab software, as recommended by Akers (2018: 90-150) which revealed the correlation between the statistical means. Therefore governance approval in the first attempt proved to be a root cause for the delayed start of projects. This finding correlated with the empirical evidence as well as the feedback from respondents. The challenge of lack of investor confidence leading to a lack of funding was discussed in the context of this study and bears relevance to the study objectives as discussed earlier.

4.5 Interpretation of data analysis

The absence of good practice in project selection and delays in governance approvals were identified as root causes aligned with the research objectives. Improvements could be implemented with minimal support, buy in and approval from the rest of the organization. The analysis of the themes were thereafter transposed into suggested improvements as listed in Table 4.7. The value added in transforming the thematic analysis into organizational improvements was guided by the empirical and theoretical review of literature on project selection, project prioritization and multi criteria decision making as discussed in the literature review (Wieggers, 2017:1-4), (Mohagheghi, Mousavi, Aghamohagheghi, and Vahdani, 2017:1-22), (Korotin, Popov, Tolokonsky, Islamov and Ulchenkov, 2017:50-58), (Stewart, 2016: 23-33), (Morton, Keisler, and Salo, 2016:1-43). In addition, the Six Sigma methodology by Alexandra and Pinto (2014:912-920) guided the researcher in:

- ❖ Creating necessary and creative solutions
- ❖ Selecting the most suitable solutions
- ❖ Assessing the risk of the chosen solution
- ❖ Implementing, planning and execution

Table 4.7: List of Improvements based on analysis of codes

List of Improvements			
	Project Selection		Governance Processes
1	Develop a project selection model	2	Consequence Management when one deviates from the governance process
3	CAPIT committee preview and sign off to support projects listed on corporate plan	4	Develop a checklist of items needed before one goes to a governance committee.
5	Develop a tighter process that will ensure proper projects are selected.	6	Develop approval gate pipeline aligned to project schedules
7	Operations to investigate operational fit for project	8	Governance committee must be staffed with adequate resources
9	ORS must be prepared by business before a project is listed on the corporate plan	10	governance committees must have multi-disciplinary skills and competencies
11	project must demonstrate strategic fit and alignment with port development framework plan	12	ongoing quality audits both internal and external to ensure business benefits realization
13	include in CAPIT resolution that the project sponsor defends the project at the approval committees		

Once again, guided by the DMAIC process, the researcher used the prioritization matrix on Table 4.8 to map out the suggested improvements on a scale of ‘ease of doing’ on the y-axis versus ‘impact through the problem’ on the x-axis. The improvements listed in the top left quadrant were those identified as quick win solutions that would address the concerns raised by the qualitative research participants and have the greatest impact on the organisation. These improvements are also highlighted in yellow on Table 4.7.

Table 4.8: Prioritization matrix

Prioritization Matrix	
High	1 6 7 12 4 3 13
Low	2 5 8 9 10 11
	High Low
Impact through the problem	

The researcher thereafter brainstormed common root causes using the affinity diagram shown in Table 4.9. The prioritized improvements were transposed onto self-stick notes. Ideas were generated on each of the improvements listed on the self-stick notes and these were then arranged into related groups as per the categories identified previously. Based on the prioritized list of improvements shown on Table 4.9, the researcher proceeded to develop a project selection model for infrastructure investment programmes within the Ports Authority, South Africa.

Table 4.9: Affinity Diagram

Affinity Diagram			
Project Selection	Resource Capacity	Governance Processes	Benefits Realization
Develop a project selection model		Consequence Management when one deviates from the governance process	
CAPIT committee preview to support corporate plan		Develop a checklist of items needed before one goes to a governance committee.	
Develop a tighter process that will ensure proper projects are selected.		Develop approval gate pipeline aligned to project schedules	

A clear outcome of the coding, analysis and improvements recommended by the qualitative research indicated that a framework for project selection was lacking within the Ports Authority. This affected critical decision making in capital investment with respect to selecting the right project portfolio with the balance and mix of projects to support the business strategy. Therefore, by combining discussions in literature review, analysis of the qualitative interviews and international best practice of selecting projects, the researcher proposed a process or framework for project portfolio selection to ensure successful realization of corporate strategy. This process can also be easily and practically adapted by other state-owned enterprises in South Africa and globally. In order to implement any improvement within the organization, the PLP process, discussed in the literature review, needed to be updated, approved and communicated to all employees. An update of the existing capital expenditure approval process for funding of infrastructure projects was therefore updated to reflect the suggested improvements. The model was reviewed by various committees within the Ports Authority prior to approval for implementation i.e. Project Management Office, the Infrastructure and Planning Executive Committee and the Ports Authority Capital Approval Committee. Figure 4.7 indicates the recommended improvements on the process map, illustrated in green blocks that could be seamlessly integrated into the existing capital approval process.

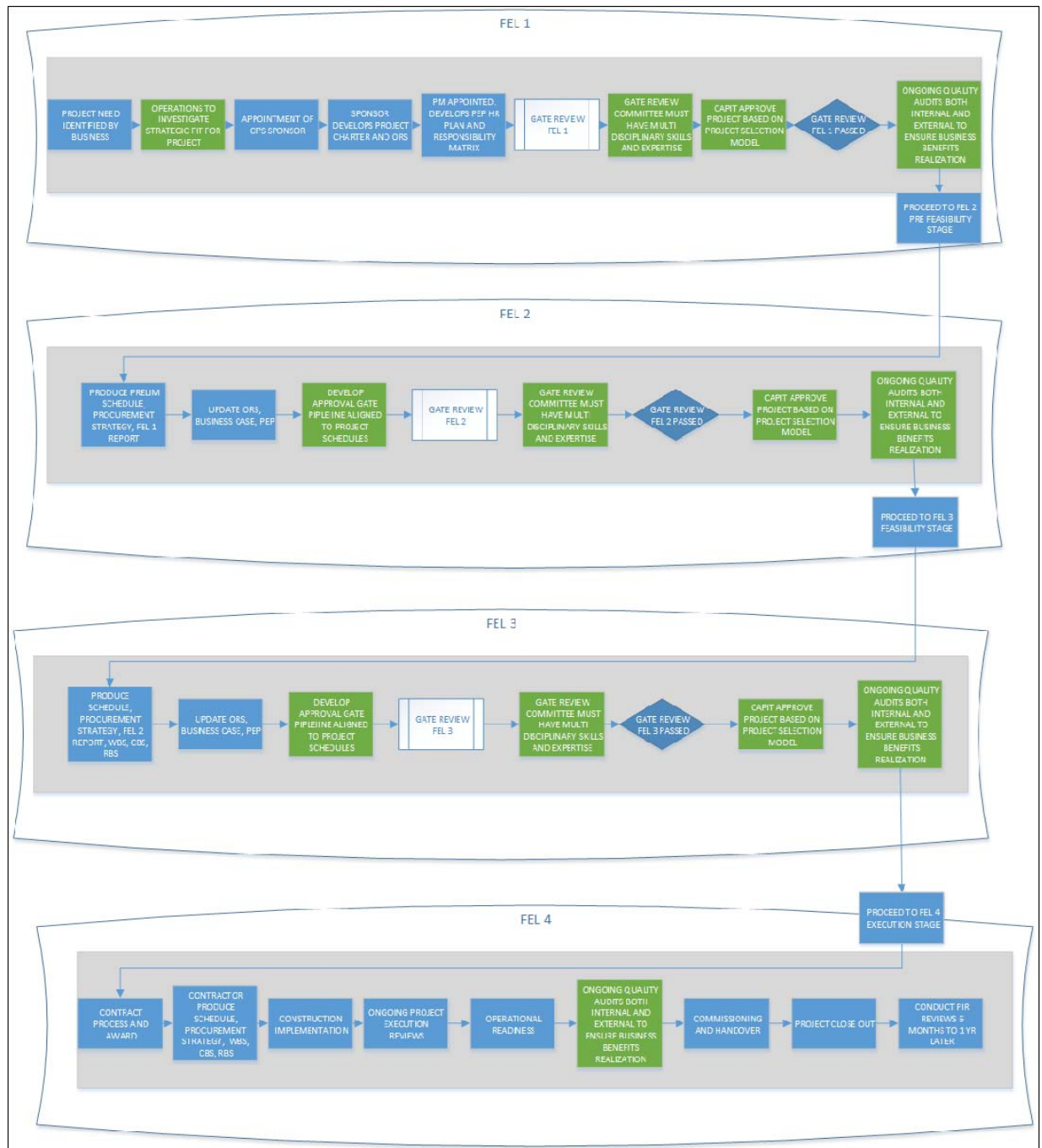


Figure 4.7: Proposed Process Map for Project Portfolio Selection

4.6 Development of the Project selection model

4.6.1 Developing the project selection model:

In the qualitative phase of the research, the researcher designed the research instruments to establish if a defined process existed within the Ports Authority for the capital approval committee to interrogate projects for strategic fit, business ranking or prioritization. The outcome of the qualitative research established that the approval of capital projects was generally non-standardised, unstructured and leaned towards subjectivity in the selection of projects for

infrastructure investment. Hence all projects listed on the corporate plan were competing for the same limited funding irrespective of the organisational risk or benefit from any project. As an outcome of the qualitative interviews, it was clear that the approval committees within the Ports Authority do not adopt any theoretical framework or process of project selection and may lean towards subjectivity in project deferrals or approvals. The chairman of the gate review, investment forum or capital expenditure approval committee directly monitors and controls the approval process. The delegated approval authority selects the members of the committee required to support their review of business case submissions for approval of capital investment on infrastructure projects. These members of governance forums did not change based on the context, scope, applicability of the projects. In analysing the feedback from interviews conducted during the qualitative research, the interviewees repeatedly cited one of the key reasons for capital underspend on infrastructure as being the lack of a specific project selection framework or process within the organisation to guide the investments in capital infrastructure. A clear outcome of the coding, analysis and improvements recommended by the qualitative research indicated that a framework of project selection was still lacking in the Ports Authority. This affected critical decision making in capital investment with respect to selecting the right project portfolio with the right balance and mix of projects to support the business strategy.

Project ranking and selection criteria identified through analysis of the qualitative data formed the basis for the independent variables as follows:

- Finance and funding: revenue growth, financial viability (NPV, IRR etc.)
- Capacity creation: Maintain adequate, reliable port Infrastructure and Fleet.
Increase infrastructure/ Fleet capacity and/ or support/promote market growth
Promote optimized land use
- Quantifiable operational efficiencies : to promote volume growth or sustainability, promote customer satisfaction and improve market share
- Safety: Improved safety levels to Reduce/eradicate the number if injuries and fatalities to staff and other port users.
- Regulatory/Environmental compliance: Contribution to sustainable green port system
- Enterprise risk: Impact on business if project is not undertaken
- Job creation/ skills development: direct project contribution to skills and jobs
- Overall alignment to business goals: strategic fit

The empirical and theoretical reviews recommended utilising a ranking or prioritisation model to ensure that projects selected within the various investment programmes would assist the Ports Authority in achieving its strategic business objectives. To support organisational objectives, a transparent, objective and quantifiable approach to prioritising infrastructure projects was applied by implementing a project prioritisation model (Calafiore, 2017:55-87) (Jones, Moura and Domingos, 2014:400-409)(Nonino, 2017:245-263) The qualitative research revealed that project performance was directly influenced by the strategic alignment between projects and organizational core obligations. The research participants also agreed unequivocally that selection of projects for the infrastructure investment programme should be done within the context of a project selection model aligned to best practice. From some of the pertinent literature reviewed in this study, it was evident that every organisation determines its own unique criteria and weights those criteria based on organisational values, strategic direction, organizational goals,

available resources, and so on. While selection and prioritization models have been used successfully across the globe, the actual metrics used to rank and select projects is specific to each organisation (Nonino, 2017:245-263). Projects are then scored and prioritized based on the selected criteria. Once projects are prioritized and those priorities are reviewed and discussed, the organisation can evaluate the results to determine funding and resource allocation for the higher priority projects. A final step involves assessing how and when (or if) to fund the lower priority projects in the future if/when more resources become available (Calafiore, 2017:55-87) (Jones, Moura and Domingos, 2014:400-409) (Nonino, 2017:245-263). The academic benefits of project selection, ranking and prioritization have been explored in the literature review chapter of this research and were established through the outcomes of the qualitative interviews.

The model was implemented to guide projects selected within the various portfolios to assist the Ports Authority in achieving its strategic objectives. This model would be used to generate optimal portfolio options based on approved capital management principles and organisational affordability. The academic benefits of project selection, ranking and prioritization had been explored in the literature review chapter of this research and had been established through the outcomes of the qualitative interviews. The literature review within this study focused on evaluating the types of prioritization models best suited for the Ports Authority business environment as recommended by best practice. To recap, the literature review investigated the Analytical Hierarchical Process (AHP), described by Velasquez and Hester (2013:1-11), as a project selection framework consistent with the methods of Multi Criteria Decision Making Methods and comprised of the three step approach as follows:

- 1) Identify and select criteria
- 2) Weight the criteria and build consensus with respect to their contextual importance
- 3) Evaluate the project proposals using the weighted criteria

A key characteristic of the AHP method is the use of pair-wise comparisons that relied on the judgement of experts to derive priority scales that were scalable and could easily adjust in size to accommodate decision making problems. AHP did not allow individuals to perform comparative analyses in isolation without identifying comparative weaknesses and strengths of the selection. The AHP is used effectively in organisations and positioned as superior to other project selection techniques as it relies on the judgement of experts within the organisation to devise priority scales and this allows contextual fit into the organisation. A further advantage is that the AHP while not as data intensive as other methods, is easily scalable and adjusts easily to accommodate decision making problems (Velasquez and Hester, 2013:1-11) (Butcher and Schutte, 2016:1-19). The project selection criteria had been identified as an outcome of the qualitative analysis. In the literature review chapter the researcher reviewed the organisational benefits of selecting and prioritizing projects for capital investment. Among these benefits were the following:

- 1) Helps prioritise complex or unclear issues when there are multiple criteria for determining importance;
- 2) Provides a consistent method of evaluating options;
- 3) Removes emotions from the process;
- 4) Ensures the effective utilisation of Ports Authority resources;
- 5) Quantifies the decisions with numeric rankings; and
- 6) Establishes a platform for conversation about what should be prioritised.

The Ports Authority previously used a corporate plan as a framework for project selection in each financial year. The corporate plan was essentially a list of projects for each of the ports per financial year listing the financial goals of the projects. The corporate plan, while it served the purpose of a portfolio plan (Wheeler, 2013: IV) (Nonino, 2017:1-19) did not consider the optimal resource mix for delivery of projects, organizational goals, interrelationships and dependencies of projects or any risks and mitigations honoring constraints imposed by customers, strategic objectives, or external real-world factors. The projects are not interrogated for strategic fit, ranked or prioritized. From recent trend analysis reports (Transnet, 2018), on average only 30% of the projects listed on the corporate plan were executed within any financial year. This dismal success rate had a direct impact on the tariff application for subsequent years. The Ports Regulator South Africa (PRSA, 2018) issued a record of decision with respect to the Tariff Application by the Ports Authority for the Tariff Years 2017/18 - 2019/20. The Ports Authority requested a tariff increase of 8.02% for the 2017/18 tariff year. In addition, and in line with the Tariff Manual Section 72 of the National Ports Act, 12 of 2005 (the Act), for approval of the tariffs for services and facilities offered by the Ports Authority for the period 1 April 2017 to 31 March 2018, the Ports Authority had applied for an indicative tariff of 25.11% and 9.54% for 2018/19 and 2019/20 respectively. This followed an application for a 5.90% tariff increase for 2016/17 after which, considering updated information, the Regulator decided on a 0% average tariff increase. The PRSA had further approved a budget of 5.8% for 2019/20. The implications for tariff reductions were far reaching as the tariff was the primary source of income for the Ports Authority and was used in part to sustain and develop infrastructure so that the port responds to customers' demands and remains globally competitive. According to the Ports Regulator, the past tariff applications by the Ports Authority provided high level generic information that often times did not materialise resulting in the customers paying for the promise of services and infrastructure that was not provided. As part of the regulator's requests for more detailed articulation of the 7 year capital expenditure (CAPEX, the Ports Authority was instructed to provide a three year business case pipeline with complete approved business cases as a guaranteed forward load of the infrastructure plans for development with capital commitment. The PRSA also monitored, among other factors, the manner in which the tariff was calculated with respect to the Ports Authority's regulated asset base as this informed the CAPEX component of the tariff calculation (Meyiwa and Chasomeris: 2016:1-20). The PRSA was of the opinion that the Ports Authority needed to revisit the debt structure and the cash management of debt (PRSA, 2018). The prioritisation model therefore included for the multi-year tariff approach to provide the level of certainty required by the Ports Regulator South Africa. Projects, in particular those projects with estimates greater than R 10 million, must be supported by an approved business case before it was included in the tariff application for any financial year.

4.6.1.1. Step 1: Align for strategic fit

While selection and prioritization models had been used successfully across the globe, the actual metrics used to rank and select projects was specific to each organisation. A quantitative study by Njue, Kyalo, Mulwa and Mbugua (2016:1-13) to investigate the relationship between strategy alignment and the overall performance of project portfolio management revealed that project portfolio management performance was directly influenced by the strategic alignment between projects and the organizational core obligations. From some of the pertinent literature reviewed it was evident that every organisation determined its own unique project selection criteria and weightings for those criteria based on organisational values, strategic direction, organizational goals, available resources, and so on (Wheeler, 2013:1-89) (Gosenheimer, 2012: 1-8), (Wiegers, 2017:1-4), (Steward, 2016:23-33).

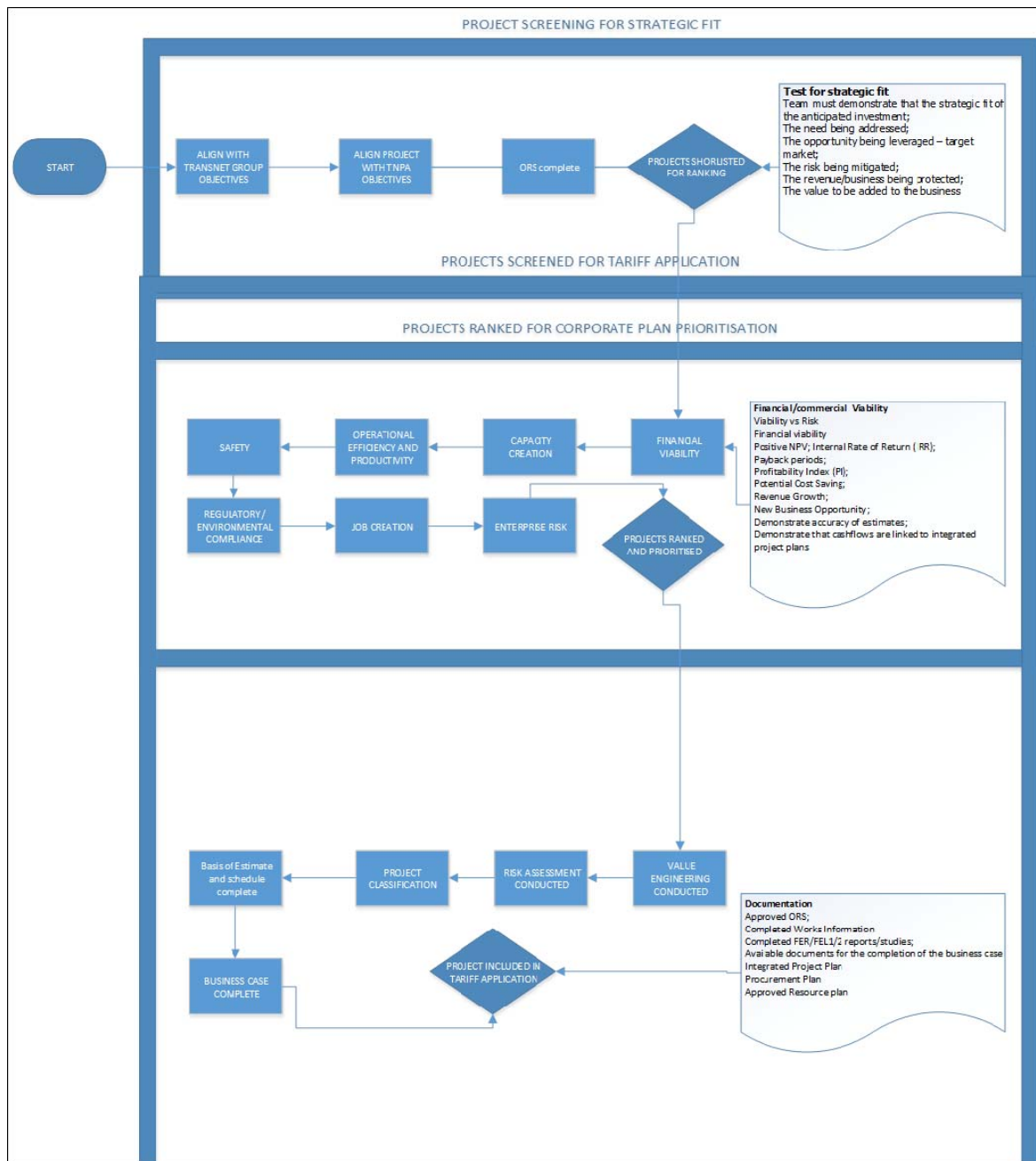


Figure 4.8: Process flow developed to test for strategic fit of projects within the Ports Authority

4.6.1.2. Step 2: Determine project categories

Even though each project was geared towards addressing a specific need within the organisation, it was recommended to categorise and group projects with similar traits and characteristics in order to simplify the management and execution of them. A balanced portfolio was more likely to deliver on the strategic objectives of the company. The following project categories were adopted within the Ports Authority corporate plan and were maintained for the project selection model:

- ❖ **External/ Internal Policy Driven:** These projects generally assisted government in achieving certain socio-economic objectives with longer term benefits for South Africa, even in the absence of adequate financial returns for the organization. Recent initiatives under this category were Operation Phakisa. Projects supporting this initiative were expected to deliver on the Phakisa vision which is to grow GDP and assist with job creation within the Marine Transport and Manufacturing sector (DPE, 2019). Projects within this category would automatically be included in the CAPEX and Strategic portfolios even if the profitability and affordability ratios were not feasible.
- ❖ **Mandatory:** These were projects which, despite the absence of adequate financial returns, needed to be undertaken by the organization. These projects would mainly deal with the maintenance of the existing business environment in terms of safety, environment and security and other compliance requirements.
- ❖ **Bulk Services:** These were projects that dealt with the provisions of basic services such as water, electricity, sewage systems, and telecommunications. Similar to the mandatory category, bulk services would need to be maintained in accordance with an asset management regime/ plan. Any expansions to existing service offerings would have to be driven by growth in commodity volumes and therefore should be accommodated as projects within the commodity capital program.
- ❖ **Discretionary:** These were projects which are driven by commodity demands. Commodity capital programs would typically fall under the category of discretionary projects and could further be subdivided into 2 sub-categories:
 - a. **Sustaining Capex:** Projects which were undertaken to preserve current revenue streams with little/ no growth prospects.
 - b. **Expansionary Capex:** Projects undertaken in anticipation of increasing capacity ahead of growing demand.

Table 4.10 is an extract of the prioritization model that aligned the key objectives of the Ports Authority with those of the holding company, Transnet SOC Ltd. Only projects that had strategic fit, with both the holding company and the operating division, Ports Authority, would be shortlisted for inclusion in the corporate plan.

Table 4.10: Measuring project value by aligning strategic fit

Port	Project Name	Project Status as per Draft 1 Budget	FEL	Transnet Group Objectives	TNPA Objectives	Project shortlisted for Ranking & Prioritisation
DBN	Project 1	Existing	FEL 4	Financial Sustainability	Port infrastructure provision and development	Yes
DBN	Project 2	Existing	FEL 4	Capacity Creation	Efficient Integrated Port System	Yes
DBN	Project 3	Existing	FEL 4	Market Segment Competitiveness	Employer/stakeholder/customer	Yes
DBN	Project 4	Future	FEL 3	Operational Excellence	SHE, security, regulatory and compliance	Yes

4.6.1.3. Step 3: Determine project selection criteria and ranking scale

The critical next step was to determine the criteria and rating scale. The project selection criteria were previously determined in section 4.3.1. Projects were then scored and prioritized based on the selected criteria. Criteria should be inserted in descending order of importance and assigned a weight. Note that when a project was scored, the numeric rating that the project was given for a particular criteria was multiplied by the criteria's weight to create a priority score. These selected criteria guided teams on selecting newly qualified projects; terminating existing projects; and nurturing potential projects. Once projects were prioritized and those priorities were reviewed and discussed, the organisation could evaluate the results to determine funding and resource allocation for the higher priority projects. A final step involved assessing how and when (or if) to fund the lower priority projects in the future if/when more resources became available. Table 4.11 lists the projects selection criteria with ranking scales developed based on the Transnet corporate requirements (Transnet, 2019) (Department of Public Enterprises, 2019) (Department of Transport, 2017). These ranking scales were later tested in quantitative surveys to establish adequacy for the organisation. Criteria were listed down the left column and the weight and names of potential projects across the top (see also Appendix 5 to 9).

Table 4.11: Criteria for Project Selection

Criteria for Project Selection	Example of Ranking																																										
<i>Financial/commercial Viability</i> › Viability vs Risk › Financial viability – Positive NPV; Internal Rate of Return (IRR); – Payback periods; – Profitability Index (PI); – Potential Cost Saving; – Revenue Growth; – New Business Opportunity; – Demonstrate accuracy of estimates; – Demonstrate that cash flows are linked to integrated project plans	Example: PI Scales <table border="1"> <thead> <tr> <th colspan="2">PI Scale</th></tr> <tr> <th>Scales</th><th>PI</th></tr> </thead> <tbody> <tr> <td>1</td><td>0.0 – 0.5</td></tr> <tr> <td>2</td><td>0.6 – 0.9</td></tr> <tr> <td>3</td><td>1.0 – 2.9</td></tr> <tr> <td>4</td><td>3.0 – 5.0</td></tr> <tr> <td>5</td><td>5.1 ></td></tr> </tbody> </table> Example: IRR Scale <table border="1"> <thead> <tr> <th colspan="2">IRR Scale</th></tr> <tr> <th>Scales</th><th>IRR %</th></tr> </thead> <tbody> <tr> <td>1</td><td>0 – 20</td></tr> <tr> <td>2</td><td>21 – 40</td></tr> <tr> <td>3</td><td>41 - 60</td></tr> <tr> <td>4</td><td>60 - 80</td></tr> <tr> <td>5</td><td>80 ></td></tr> </tbody> </table> Example: GDP <table border="1"> <thead> <tr> <th colspan="2">GDP Scale</th></tr> <tr> <th>Scales</th><th>GDP</th></tr> </thead> <tbody> <tr> <td>1</td><td>0 - 200 000 000</td></tr> <tr> <td>2</td><td>200 000 001 – 700 000 000</td></tr> <tr> <td>3</td><td>700 000 001 – 1 000 000 000</td></tr> <tr> <td>4</td><td>1 000 000 001 – 3 000 000 000</td></tr> <tr> <td>5</td><td>3 000 000 001 ></td></tr> </tbody> </table>	PI Scale		Scales	PI	1	0.0 – 0.5	2	0.6 – 0.9	3	1.0 – 2.9	4	3.0 – 5.0	5	5.1 >	IRR Scale		Scales	IRR %	1	0 – 20	2	21 – 40	3	41 - 60	4	60 - 80	5	80 >	GDP Scale		Scales	GDP	1	0 - 200 000 000	2	200 000 001 – 700 000 000	3	700 000 001 – 1 000 000 000	4	1 000 000 001 – 3 000 000 000	5	3 000 000 001 >
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<i>Enterprise Risk</i> <i>Coincidence of Project risk to top 10 Transnet Enterprise Risks identified</i>	<table> <tr> <th colspan="2">Enterprise Risk</th></tr> <tr> <th>Scale</th><th>Number of Risks</th></tr> <tr> <td>1</td><td>5></td></tr> <tr> <td>2</td><td>4</td></tr> <tr> <td>3</td><td>3</td></tr> <tr> <td>4</td><td>2</td></tr> <tr> <td>5</td><td>1<</td></tr> </table>	Enterprise Risk		Scale	Number of Risks	1	5>	2	4	3	3	4	2	5	1<
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4.4.1.4. Step 4: Instructions to populate the project selection model

Table 4.12 provides instructions to populate the project selection model.

Table 4.12: Instructions to populate the project selection model

	INSTRUCTIONS TO POPULATE THE PROJECT SELECTION MODEL
1	What it is:

	The project selection model allows the project team and owner to identify, analyse, and rate the strength of relationships between sets of information pertaining to evaluating various capital investment options during FEL-1 and FEL-2. (pre-screening of options only FEL 1)
2	When to use it:
	The selection model is prepared during Project Initiation to select product/service features and Owner goals, develop process steps and weigh alternatives. The Project Manager will agree the selection criteria with the Owner during the project phase, however this must be done prior to project selection. The criteria will be applied during the project phase to evaluate the alternative options. Cross checks must also be done, such as: • Warrant numbers must be matched with an approved ETC. Warrant numbers can be duplicated. Produce a report showing projects making up a total warrant. This will assist with manual checks. • Actuals may not exist without a warrant number. • Exception report is required where Latest ETC exceeds the approved ETC • Alignment between various classification fields such as Programme level 1 & 2, OD Programme, Category/subcategory, Corridor, Province, Commodity, Location and Asset Group. • Mandatory projects must indicate why by specifying the applicable Regulation Name. • Projects going beyond 1 year must show escalations. • Rand equivalents of Forex may not exceed the planned cost for that year. • Contingency may not be less than R1. • Exception report required where FEL 3/4 do not align with planned cash flows. • Commitments plus Actuals for the current financial year may not exceed LE.
3	How to use it:
a.	The model is set up so that the project can only be ranked and prioritized if columns G - O are populated and there is a yes in any of columns I - L.
b.	Assign weights. Under the Criterion Weighting Column, weight the criterion in terms of Owner's importance. The overall weighting must equal 100%. If some decision criteria are more important than others, review and agree on appropriate weights to assign. The criterion and weightings must be signed off by the Owner prior to evaluating the alternatives / options and a copy must be submitted as part of the Gate Review Pack
c.	Design scoring system. Before rating the alternatives, the team must agree on a scoring system. Determine the scoring range (e.g., 1 to 5) and ensure that all team members have a common understanding of what the scores represent. For example:
	Scoring System
	1 = No match, does not satisfy criterion
	2 = Poor Match, major deviations
	3 = Average Match
	4 = Good Match, minor deviations
	5 = Matches 100%
d.	Total the scores. Multiply the score for each decision criterion by its weighting factor. Then total the scores for each alternative being considered and analyse the results.
4	Approvals
	The Owner will sign the Selection Model and note whether they agree with the proposed option or select one of the alternatives

The Project Selection Model is to be read in conjunction with the step by step instructions below on how to populate the model (Appendices 5 to 9).

- A. Columns **A to F, AG to AM** are pre-populated as per the information submitted to Head Office for approval.
- B. Filter **Column C** and select the port.
- C. Check status in **Column E** and select the correct status (**New, Future, Deferred, Complete or Cancelled**). Note that the status captured is as per the submission to Group).

- D. Select the Project Category from **Column Q**-
 - i. Bulk services
 - ii. Discretionary
 - iii. External Influence – Phakisa
 - iv. External/Internal Policy Driven
 - v. Mandatory
- E. Confirm FEL status in **Column F**.
- F. Confirm if project is committed financially for the current and following year (contract in place) in **Column N**.
- G. Confirm project interdependency – **Column L**. This is very important as project dependencies must be evaluated to ensure that projects are not negatively impacted (delays in execution, delays in utilising assets, etc.) as a result of a dependencies.
- H. Enter data in **Column R** – name of dependent project.

4.6.1.5. Step 5: Project scoring

For this step teams were required to review each project and rank the project on each of the criteria.

- A. Input scores ranging from 1 to 5 in columns **AS - BF**. Utilise the scoring guidelines
- B. The score is automatically calculated in column **AE**. After projects have been scored discuss results for sanity check and develop a master list of prioritized projects based on consensus from the team.
- D. As a final step, establish groupings of projects based on scoring, for high, medium and low priority.

Within the Ports Authority, the Project Management Office would guide project teams through the recommended process shown in Figure 4.9:

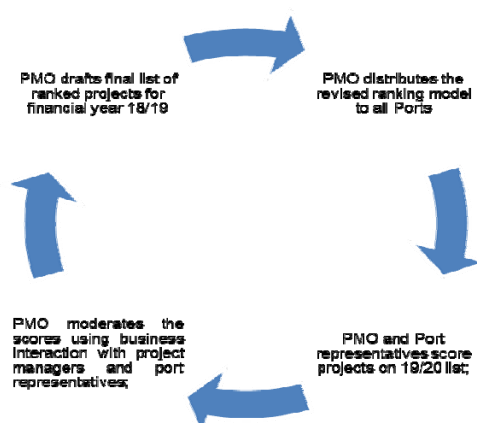


Figure 4.9: The recommended scoring process for the project selection model

4.6.1.6. Step 6: Moderation of project scores

The Enterprise Portfolio Management Office (EPMO) would thereafter moderate scores and utilise input to prepare a consolidated ranked and prioritised list of all projects competing for capital investment within the Ports Authority. Projects would then be selected with due consideration to the organisation’s strategic objectives and the availability of key resources. The EPMO would endeavour to select a balanced portfolio with the greatest potential to support the achievement of the organisation’s strategic objectives and the greatest value creation. This would be done in

conjunction with the relevant capital approval governance committees. During moderation, the EPMO would check for the following:

- A. Strategic level planning – alignment with corporate strategy, National Ports Plan and Port Development Framework Plan
- B. Identify organisational (or departmental) drivers
- C. Make sure that projects were properly defined
- D. Identify the project drivers and group projects into programmes where possible
- E. Verify the project estimates based on historical evidence
- F. Ensure projects with the same purpose were scored similarly at all ports and across different financial years

The EPMO would input a moderated score for each project in column **AF**. The rankings in Column AF would feature in capital investment decisions on when to defer, cancel or accelerate projects. The project selection model would be used to make transparent and objective trade off decisions aligned to the organisational objectives when evaluating the priority of proposed new projects or emergency/ unforeseen projects to estimate their priority for capital investment within the Ports Authority. The model would also be used to choose an appropriate implementation sequence aligned with the National Ports Plan and the Port Development Framework Plan together with port master plans for bulk services. The final decision-making body would reside within the office of the project sponsor and delegated authority. The outcome of the process would be communicated to all relevant parties through the normal CAPIC communication channels.

4.7 Chapter summary

Based on the empirical and theoretical gaps identified in the problem statement, this chapter discussed the data collection and handling from the six (6) respondents out of a purposive sample of twenty(20) participants who were members of the governance forums for capital investment in infrastructure project selection. The sample constituted members of the Gate Review, Investment Forum and Capital Investment Committee (CAPIC) approval committees at the Ports Authority. These employees were integral to good governance and approvals for infrastructure development within the Ports Authority. This section also discussed techniques adopted in the coding and analysis of the interview data transcripts together with any impediments experienced during the research. As an outcome of this chapter and based on the graphical and statistical analysis of the data using Six Sigma methodologies, the following criteria were identified as root causes for delayed start of projects and subsequent underspending of capital as budgeted on the corporate plan:

- i. Project selection was a root cause for the delayed start of projects
- ii. Governance approval in the first attempt was a root cause for the delayed start of projects.

The sub- objectives of this phase of the study aimed to identify those quick win project selection criteria aligned to the Ports Authority's strategic objectives in order to select and prioritize projects for execution. The researcher analysed respondent feedback received from the qualitative interviews using semi-structured questionnaires. The findings of the qualitative research determined the key project selection criteria used to develop the model for selection and prioritization of projects. These criteria were used to benchmark the current practice against the best practice in relation to the selection, ranking and prioritization of projects at the Ports Authority, a division of Transnet SOC Ltd, a state-owned entity.

The data analysis answered the research question by confirming that the project selection criteria does indeed influence project selection and prioritization for business success at the Ports Authority in South Africa. As an outcome of the qualitative research, the researcher implemented suggested improvements through interpretation of the results from the data analysis indicated in Table 4.9 as follows:

- i. Developed a process flow for project selection within the Ports Authority
- ii. Developed a project selection model to support infrastructure investment programmes within the Ports Authority, South Africa
- iii. Developed the instructions to populate the project selection model

The following chapter analyses and interprets the respondent feedback received from the quantitative surveys. The results were presented using descriptive statistics in the form of graphs, figures and cross tabulations. Inferential techniques included the use of correlations and chi square test values; which were interpreted using the p-values.

CHAPTER 5

DATA PRESENTATION, ANALYSIS AND INTERPRETATION OF FINDINGS: QUANTITATIVE RESEARCH

5.1 Introduction

As a deductive outcome, the qualitative research, in the last chapter, responded to the problem statement identified through the empirical knowledge gap by determining the project selection criteria and developing a project selection model aligned with best practice for infrastructure investment programmes. The model was implemented over a period of six (6) months before the quantitative research was initiated. The model implementation timeframe was only part of the financial year 2018/2019 but was important in developing a basis for the prioritized infrastructure investment programme that was to be included in the tariff application to the Ports Regulator South Africa.

As an outcome, this chapter sought to analyse and interpret the respondent feedback received from the quantitative surveys. This chapter therefore discussed the reliability statistics from simple random sampling of the target population of 108 employees that constituted the study population involved or impacted directly by the capital approval process for infrastructure projects. Techniques adopted in the analysis of quantitative questionnaires to test the impact of the independent variable on the dependent variable were also discussed. Data analysis included the use of descriptive statistics such as means, frequencies and standard deviation. The results were presented using descriptive statistics in the form of graphs, figures and cross tabulations. Inferential techniques included the use of correlations and chi square test values; which were interpreted using the p-values. Structural equation modelling was done to determine the relationship between the independent variable and the dependent variable in testing the hypothesis. This chapter also includes interpretation of the results from the data analysis and triangulation of results from the mixed method research using exploratory sequential design.

5.1.1 Quantitative research objectives

The objective of the quantitative research was to test the project selection criteria identified through data analysis of the qualitative research. The research instrument can be found in Appendix 4. The researcher used the existing format of the Ports Authority corporate plan (Transnet, 2019) to align recommendations from best practice and thereby developed a project selection model for capital investment in infrastructure programmes at the Ports Authority. The quantitative research also tested the effectiveness of the project selection model, in prioritizing an infrastructure programme capital investment, by using quantitative research techniques.

Hypothesis: Project selection criteria influences project selection and prioritization for improved investment decisions at the Ports Authority in South Africa

Null Hypothesis: Project selection criteria does not influence project selection and prioritization for improved investment decisions at the Ports Authority in South Africa

Dependent variable: improved investment decisions

Independent variable: project selection criteria; project selection model

Research Objective: To develop a project selection model to improve infrastructure investment programmes within the Ports Authority, South Africa

Sub objectives of the study were:

- i. To identify the project selection criteria to improve project selection and prioritization at the Ports Authority in South Africa – sections 3.5.1 – 3.5.8 of the questionnaire
- ii. To assess if the project selection model guides project selection to align with the Port Authority’s strategic objectives - sections 2.1 – 2.6 and 2.7.1 – 2.7.5 of the questionnaire
- iii. To determine whether project selection and prioritization improves investment decision making - section sections 3.1 – 3.4 and 4.1 – 4.12 and 4.13.1 – 4.13.8 of the questionnaire

5.2 Reliability statistics

5.2.1 Response rate

According to Creswell and Clark (2017:130-150) the response rate indicates the reliability, dependability and validity of the research results. Due to the various levels of governance and approval authorities within the Ports Authority, the researcher was bound to comply with due diligence by getting acceptance of the research surveys and content of the study at the Infrastructure Executive Committee and the Capital Investment Committee prior to proceeding with the surveys. The researcher co-ordinated a workshop at each of the eight ports within the Ports Authority. The agenda of the workshop was to present and implement the prioritization model that was developed by the researcher, for the purpose of prioritizing the capital portfolio of projects within each port. Questionnaires were administered to all attendees at these workshops (Appendix4). There were a total of 108 employees that constituted the study population who were involved or impacted directly by the capital approval process for infrastructure projects. From historical evidence over the previous three years where only 70% of all invitees actually attend a workshop of this nature within the Ports Authority, hence the sample size was calculated at 75 (70% of 108). A confidence level of 95% was considered for this study with an acceptable margin of error of 0.05. A subject information letter was thereafter distributed to employees to create awareness of the context of the research (Appendix 3). The researcher collected 58 questionnaires from the sample. The researcher ensured that the process was conducted in an ethical and morally sensitive manner and that participants were not coerced into submitting questionnaires. The response rate was greater than 50% of the sample size and considered adequate for meaningful results and analysis (Cooper and Schindler, 2001:160-200).

5.2.2 Cronbach’s alpha co-efficient

According to Creswell and Clark (2017:130-150), the two most important aspects of precision are reliability and validity. Reliability is computed by taking several measurements on the same subjects. A reliability coefficient of 0.70 or higher was considered as “acceptable”. The analysis used the Cronbach’s Alpha co-efficient to determine whether the response rate on each of the research objectives within the questionnaires was acceptable. The table 5.1 reflects the Cronbach’s alpha score for each section that constituted the questionnaire.

Table 5.1: Cronbach's Alpha Score

		N of Items	Cronbach's Alpha
S2.1 - S2.6	Project Selection model – Objective 1	6	0.823
S2.7.1 - S2.7.5	Project selection criteria – Objective 1	5	0.831
S3.1 - S3.4	Strategic Alignment – Objective 2	4	0.909
S3.5.1 - S3.5.8	Strategic Alignment – Objective 2	8	0.720
S4.1 - S4.12	Improved decision making – Objective 3	24	0.778

The reliability scores, for all sections of the questionnaire addressing the research objectives, exceeded the recommended Cronbach's alpha value of 0.7 (Cooper and Schindler, 2001:160-200). This indicated a degree of acceptable, consistent scoring for each of the sections of the research questionnaire. Hence the data analysis could meaningfully contribute to the interpretation of the results of the quantitative research.

5.2.3 Sectional analysis of biographical data

This section of the questionnaire was used to assess the demographic information aligned to the key attributes of the sample selection. The respondents were required to indicate number of years of experience in their current role within the organisation, their job category and their region of influence within the Ports Authority. This information was critical in order for the researcher to ensure that the respondent was a good representation of the target population and was sufficiently knowledgeable about the context and the content of the research. The section analysis summarised the biographical characteristics of the respondents to ensure that the study population was adequately represented by the usable responses of the questionnaires received from the sample. Table 5.2 and figure 5.1 indicated the positions that respondents hold at the organisation.

Table 5.2: Positions held by Respondents within the Organisation

Please indicate your job category					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Project Management	20	33.9	34.5	34.5
	Project Controls	12	20.3	20.7	55.2
	Engineering	15	25.4	25.9	81.0
	Strategy and Planning	6	10.2	10.3	91.4
	Other	5	8.5	8.6	100.0
	Total	58	98.3	100.0	
Missing	System	1	1.7		
Total		59	100.0		

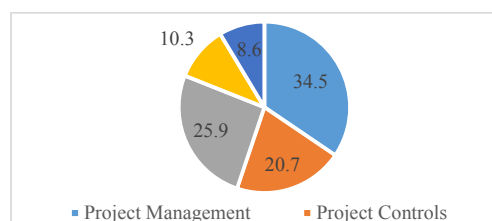


Figure 5.1: Positions held by Respondents within the Organisation

There were significant differences in the composition of the sample. A little more than a third (34.5%) of the respondents were in Project Management, with lower but similar levels (23% average) between Engineering and Project Controls. There were also similar numbers (9% average) for Strategy and Planning, and Other ($p = 0.009$).

The representation of the respondents was in keeping with the organisational employment ratios for the selected population for this study as the Project Management Office made up the biggest constituent of the population. The large number of project management and project controls respondents also added more relevance to the outcome of the research as these are the individuals working with the projects on a daily basis. Therefore, the project management team were considered value adding contributors in the responses as they were generally well informed of any and all project activities.

The table 5.3 and figure 5.2 indicated the length of service of the respondents.

Table 5.3: Length of service of respondents within the organisation

Indicate your number of years of experience in this role					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0-6	25	42.4	42.4	42.4
	7-12	22	37.3	37.3	79.7
	13-18	8	13.6	13.6	93.2
	19-24	4	6.8	6.8	100.0
	Total	59	100.0	100.0	

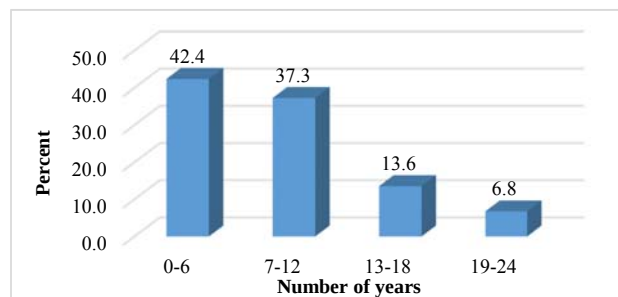


Figure 5.2: Length of service of respondents within the organisation

More than half of the respondents (57.6%) were in the position for more than 7 years ($p < 0.001$). This implies that respondents had been in employ for a while and this was a useful fact as it indicates responses from experienced workers.

According to the Transnet Online Integrated Report (Transnet, 2019) Transnet's net employment rates for 2019 improved compared to the prior year with the number of management employees increasing by 6.5%, and the number of bargaining unit employees increasing by 4.7%. The current average age of a Ports Authority employee is 43 years. While the overarching picture for the Ports Authority is that of an ageing workforce, with a significant

proportion of the organization's employees falling in the 43 to 60 years age bracket, the Project Management Office (PMO) within the Ports Authority was only established in 2013 (approximately 7 years prior to the date of this research). Upon establishing the PMO office, there was a massive recruitment drive to fill vacancies. Since the pay scales were fixed and could not be negotiated, the department was only able to attract employees within a certain skills level and experience profile. This meant that the majority of the employees within the PMO are below 40 years old. A number of new recruits are under 30 years old with minimal work experience in any other organisation expect for the PMO or other similar offices within the Transnet operational departments. While the age and experience profile would certainly affect the maturity level of the Project Management Office, the demographic feedback is a true representative of the spread of employees within the PMO.

The table 5.4 and figure 5.3 indicates the Region of Influence within the ports Authority's Project Management Office.

Table 5.4 Region of Influence of Respondents

Region of Influence within TNPA's Project Management Office					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Eastern	41	69.5	70.7	70.7
	Central	7	11.9	12.1	82.8
	Western	1	1.7	1.7	84.5
	2 or more	8	13.6	13.8	98.3
	None	1	1.7	1.7	100.0
	Total	58	98.3	100.0	
Missing	System	1	1.7		
Total		59	100.0		

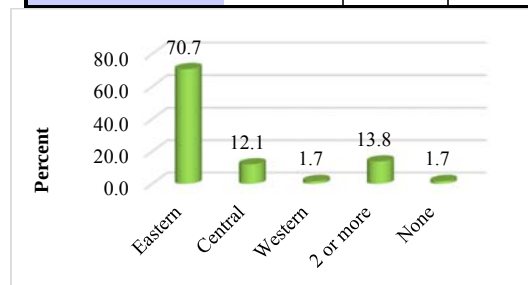


Figure 5.3: Region of Influence of Respondents

A significant number of respondents (70.7%) were from the Eastern region ($p < 0.001$). For the Financial Year 2018/19 the Ports Authority recorded a planned budget of R 2.6 billion Rand (Transnet, 2019). The Eastern region comprising the ports of Durban and Richards Bay contributed approximately R 1.05 billion or 40% towards the planned budget. Since the largest component of the project budget was managed within the Eastern region, this region also had more resources to support the workload. A rough estimate of the human resource distribution

would be 40% in the Eastern region, 20% in the Western Region, 20% in the Central Region and 20% for National and Marine projects. Hence the distribution of respondents were acceptably higher within the Eastern Region and a good representation of the population.

Although the researcher anticipated self-selection bias where respondents may choose to participate because they have a particular interest in the subject matter and convenience bias where only attendees of the workshop were administered questionnaires, the responses were still considered to be a good representation of the population as there was a fair representation from all genders, levels of seniority, knowledge, experience and departments of the population.

5.3 Quantitative analysis

5.3.1 Descriptive Statistics

The analysis, interpretation and discussion of the findings for each quantitative research objective in this study was done using section analysis, factor analysis and chi-square tests. These methods of descriptive statistics made use of statistical instruments such as tables, pie charts, bar graphs, and statistics summary such as Pearson chi square test, Kaiser-Meyer- Olkin measure and Bartlett's test of sphericity in analysis of quantitative data.

5.3.1.1 Section analysis

Section analysis used frequency graphs to summarise the scoring patterns for each objective. These were used to demonstrate the statistical significance of the variables being measured for each study objective.

5.3.1.2 Principal component analysis

According to Kothari (2004:319), a factor is an underlying dimension that accounts for several observed variables. Factor analysis is a statistical technique whose main goal is data reduction. Therefore, factor analysis, also known as the principal component analysis, is a statistical technique whose main goal is data reduction. A typical use of factor analysis is in survey research, where a researcher wishes to represent a number of questions with a small number of hypothetical factors. Factor analysis was done only for the Likert scale items in the questionnaire. A typical use of factor analysis is in survey research, where a researcher wishes to represent a number of questions with a small number of hypothetical factors (Kothari, 2004:319). With reference to the matrix tables used with factor rotation in analysis of the research objectives, the findings were as follows:

- I. The principle component analysis was used as the extraction method, and the rotation method was maximum variation with Kaiser Normalization. This is an orthogonal rotation method that minimizes the number of variables that have high loadings on each factor (Kothari, 2004:322). It simplifies the interpretation of the factors.
- II. Factor analysis/loading showed inter-correlations between variables.
- III. Items of questions that loaded similarly implied measurement along a similar factor. An examination of the content of items loading at or above 0.5 (and using the higher or highest loading in instances where items cross-loaded at greater than this value) effectively measured along the various components.

Certain components were divided into finer components and explained in the rotated component matrix which enriched the outcomes of the factor analysis. The requirement is that Kaiser-Meyer-Olkin Measure of Sampling Adequacy should be greater than 0.50 and Bartlett's Test of Sphericity less than 0.05 (Kothari, 2004:322).

Table 5.5: KMO and Bartlett's Test

		Kaiser-Meyer-Olkin Measure of Sampling Adequacy .	Bartlett's Test of Sphericity		
			Approx. Chi-Square	df	Sig.
S2.1 - S2.6	Project selection model - Objective 1	0.732	131.313	15	0.000
S2.7.1 - S2.7.5	Project selection criteria - Objective 1	0.749	111.878	10	0.000
S3.1 - S3.4	Strategic Alignment - Objective 2	0.816	167.162	6	0.000
S4.1 - S4.12	Improved investment decision making - Objective 3	0.525	177.902	66	0.000

As seen in table 5.5, for all objectives, the conditions were satisfied which allowed for the factor analysis procedure. The statements that constituted each section of the questionnaire dealing with a specific objective were loaded perfectly along a single component. This implied that the statements that constituted these objectives perfectly measured what it set out to measure.

5.3.1.3 Chi-square test

According to Kothari (2004: 229), chi-square is a statistical measure used to test significance in sampling analysis. It is a non- parametric test used to “(i) test the goodness of fit; (ii) test the significance of association between two attributes, and (iii) test the homogeneity or the significance of population variance”. To determine whether the scoring patterns per statement were significantly different per option, tests for degrees of freedom (df), significance and Chi square were done. The chi-square test was used to determine whether there was a significant difference between the expected frequencies and the observed frequencies in one or more categories of quantitative data. In this vain, the chi square tests either tested for “goodness of fit” or “test of independence” (Kothari, 2004: 229).

5.3.2 Inferential statistics

The inferential statistics were used to analyse the relationship between the independent variables (project selection criteria and project selection model) and the dependent variable (improved investment decision). Wheeler (2013:iv) recommended that “projects and programmes selected by organizations should be consistent with strategic objectives of the organization; provide value for money and return on investment; be adequately resourced and prioritized; not compete with general operations for resources and not restrict the ability of operations to provide income to the organization; match the capacity and capability of the organization to deliver; and produce outputs that are willingly accepted by end users and customers” (Wheeler:2013:iv). Korotin et al (2017: 50-58) and Mohagheghi, Mousavi and Vahdani (2016:1-28) also discussed in their studies how project selection criteria would give clear focus on the business critical or strategic projects to invest in or to defer during economic crises. Contextually, business success as applied to the infrastructure investment programmes would refer to the improvement of capital investment decisions and alignment of the infrastructure investment programme to the strategic objectives of the organisation as outlined by the Department of Public Enterprises (DPE, 2019). Business success would also imply that the annual tariff application from the Ports Authority was accepted by the Ports Regulator South Africa as this is the main income stream for the ports. An acceptably

regulated tariff would also make the Ports Authority more attractive for investment in infrastructure. Using inferential statistics the study aimed to demonstrate the causal relationship of the main components to improved investment decisions (S4.1 - S4.12) with the independent variables, project selection criteria (S3.5) and project selection model (S2.1 – 2.6) and (S3.1 – 3.4).

5.3.2.1 Cross Tabulations

The results of the Chi-Square tests were used to find a correlation in the relationship between two sets of data through cross tabulations for a more meaningful analysis contributing to the responses. In this case the comparison was done between the biographical data and the research questions in section 4 of the quantitative questionnaire that dealt with improved investment decisions for business success. To calculate Chi-Square, the researcher used a cross-tabulation which illustrated the frequencies of joint occurrences between two variables (Cooper and Schindler, 2001: 470-475)

5.3.2.2 Correlation

Bivariate correlation was performed on the (ordinal) data. The correlations table displays Pearson correlation coefficients, significance values, and the number of cases with non-missing values (N). The values of the correlation coefficient ranged from -1 to 1. The sign of the correlation coefficient indicated the direction of the relationship (positive or negative). The absolute value of the correlation coefficient indicated the strength, with larger absolute values indicating stronger relationships (Cooper and Schindler, 2001: 540-542). The correlation coefficients on the main diagonal were always 1, because each variable had a perfect positive linear relationship with itself. The significance of each correlation coefficient was also displayed in the correlation table. The significance level (or p-value) indicated the probability of obtaining results as extreme as the one observed. If the significance level was very small (less than 0.05) then the correlation was significant and the two variables were linearly related. If the significance level was relatively large (for example, 0.50) then the correlation was not significant and the two variables were not linearly related. Positive values indicated a directly proportional relationship between the variables and a negative value indicated an inverse relationship. All significant relationships were indicated by a * or **. The correlation results can be found in the appendix 10.

5.4 Objective 1: To identify the project selection criteria to improve project selection and prioritization at the Ports Authority in South Africa

Section 3.5.1 – 3.5.8 of the questionnaire were designed to test the first study objective of the quantitative research defined as an outcome of the qualitative analysis.

Table 5.6: Summarizing scoring patterns for Objective 1 of Quantitative Survey

	Yes		No	
	Frequency	Percent	Frequency	Percent
FINANCE AND FUNDING: revenue growth, financial viability (NPV, IRR etc)	59	100.0		

CAPACITY CREATION: Maintain adequate, reliable port Infrastructure and Fleet. Increase infrastructure/ Fleet capacity and/ or support/promote market growth, Promote optimized land use	56	98.2	1	1.8
QUANTIFIABLE OPERATIONAL EFFICIENCIES: to promote volume growth or sustainability, promote customer satisfaction and improve market share	56	98.2	1	1.8
SAFETY: Improved safety levels to Reduce/eradicate the number if injuries and fatalities to staff and other port users.	59	100.0		
REGULATORY/ENVIRONMENTAL COMPLIANCE: Contribution to sustainable green port system	59	100.0		
ENTREPRISE RISK: Impact on business if project is not undertaken	54	94.7	3	5.3
JOB CREATION/ SKILLS DEVELOPMENT: direct project contribution to skills and jobs	55	96.5	2	3.5
OVERALL ALIGNMENT TO BUSINESS GOALS: strategic fit	56	98.2	1	1.8

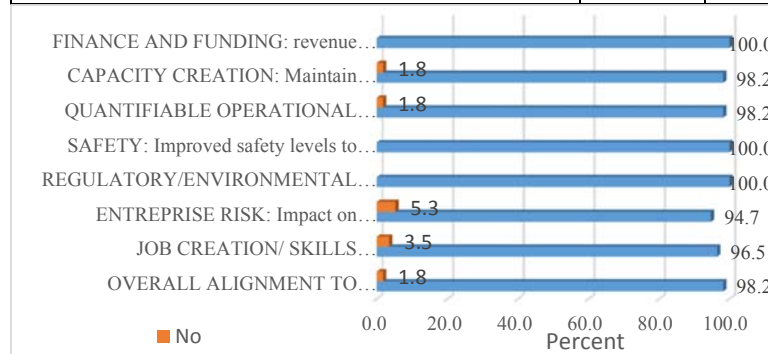


Figure 5.4: Frequency graph summarizing scoring patterns for Objective 2 of Quantitative Survey

There was a significant pattern of using “Yes” to the stated criteria ($p < 0.001$). In analysis of the respondents’ feedback (table 5.6 and figure 5.4), the researcher sought to establish that there was no coercion prompting such strong agreement with the project selection criteria amongst respondents. Revisiting the measures taken to ensure ethical considerations and removal of bias from the process, it seemed valid that responses were a clear indication of the respondents with the project selection criteria used in the project selection model. The fact that most of the respondents seemed to support the project selection criteria gave further credence to its relevance and importance.

There was a 5.3% level of non-agreement amongst respondents that Enterprise risk should not be one of the project selection criteria included in the prioritization model. Enterprise Risk, in this context, referred to the impact on business if the project under review was not undertaken. According to the International Standards Organisation (ISO) and in particular code ISO 31000 (2009), risk was “The effect of uncertainty on objectives”. Risk management involves the achieving of an appropriate balance between realizing opportunities for gains while minimizing adverse impacts (ISO 31000, 2009). Risk management is an integral part of good management practice and an essential element of good corporate governance. Risk management is an iterative process consisting of steps that, when undertaken in sequence, enables continuous improvement in decision-making and facilitates continuous improvement in performance. The King Report on Corporate Governance in South Africa (King iii, 2010) defines risk as “any uncertain future events that could influence, both in a negative and a positive

manner, the achievement of the company’s objectives”. Risks can apply to all levels of an organization or project. Corporate risk is typically reflective of the aggregate of all potential negative events or opportunities across an entire organization. Corporate risk is most commonly referred to as enterprise-wide risk. Project risk, on the other hand is defined as the chance of an event happening which would cause the actual project circumstances to differ from those assumed when forecasting project benefits and costs (Rose, 2013:76). These events could have either positive or negative impacts on the project. The Enterprise Risk Management department within Transnet recognized the important of risk management by creating a generic operating practice for treatment of risks within the organization. The fundamental tenets of this practice was to understand the causes of the risk occurrence so as to avoid recurrence, measure the business impact and thereby develop contingency plans to mitigate the risk. In the context of project selection, risk identification also looked at the impact of opportunity costs of not undertaking a project, the interdependencies on other projects and business operations if a project was not selected or prioritized, identifying the triggers to avoid recurrence of the risk, managing the impact of the risk to the organization and monitoring and controlling the risk triggers to avoid CAPEX underspend, project delays and deferral, for instance. In the past, the underspending in CAPEX, risks, reasons and mitigations, were not effectively communicated as part of the stakeholder management plan which lead to a general perception that Transnet was performing poorly. Relevant, critical information dissemination would equip stakeholders with the knowledge to understand the reasons and make realistic conclusions and even provide support and solutions where possible. The Ports Authority recognized Enterprise Risk Management as a key component to improved investment decisions. The PMO supported this thinking especially in project selection and prioritization. Hence this criterion remained integral to the project selection criteria within the prioritization model.

Although 3.5% of respondents did not see the relevance of the criterion for job creation and skills development in project selection and prioritization, job creation was one of the key performance indicators within Transnet and its operating divisions. With the infrastructure budget constraints and the volatility of the world economy, it was of utmost importance that the Capital portfolio selected would assist the Ports Authority in job creation in order to stimulate the economy. Projects that supported the job creation initiative were automatically included in the CAPEX and strategic portfolios.

The reasons for not having 100% agreement could be based on respondents not being exposed to those aspects of the business, or to respondents not seeing a contribution of those criteria to successfully selecting projects for infrastructure investment within the Ports Authority. Since those percentages of respondents were below 6% the researcher focused on only those criteria that seemed to have a comparatively greater level of agreement.

To determine whether the scoring patterns per statement were significantly different per option, a chi square test was done. The chi-squared test in Table 5.7 was used to determine whether there was a significant difference between the expected frequencies and the observed frequencies in one or more categories. In this vain, the chi square tests either tested for ‘goodness of fit’ or ‘test of independence’.

Table 5.7: Chi Square test results for Objective 1

Chi-Square	df	Asymp. Sig.
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S3.5.1	FINANCE AND FUNDING: revenue growth, financial viability (NPV, IRR etc)			
S3.5.2	CAPACITY CREATION: Maintain adequate, reliable port Infrastructure and Fleet. Increase infrastructure/ Fleet capacity and/ or support/promote market growth, Promote optimized land use	53.07	1	0.000
S3.5.3	QUANTIFIABLE OPERATIONAL EFFICIENCIES : to promote volume growth or sustainability, promote customer satisfaction and improve market share	53.07	1	0.000
S3.5.4	SAFETY: Improved safety levels to Reduce/eradicate the number if injuries and fatalities to staff and other port users.			
S3.5.6	ENTREPRISE RISK: Impact on business if project is not undertaken	45.632	1	0.000
S3.5.7	JOB CREATION/ SKILLS DEVELOPMENT: direct project contribution to skills and jobs	49.281	1	0.000
S3.5.8	OVERALL ALIGNMENT TO BUSINESS GOALS: strategic fit	53.07	1	0.000

The highlighted sig. values (p-values) were less than 0.05 (the level of significance), which implied that the distributions were not similar. That was, the differences between the way respondents scored (agree, neither agree nor disagree, disagree) were significant.

Table 5.8: Principal Component Analysis of Objective 1

Component Matrix ^a	
S3.5.1 - S3.5.8	Component 1
FINANCE AND FUNDING: revenue growth, financial viability (NPV, IRR etc)	0.788
CAPACITY CREATION: Maintain adequate, reliable port Infrastructure and Fleet. Increase infrastructure/ Fleet capacity and/ or support/promote market growth, Promote optimized land use	0.652
QUANTIFIABLE OPERATIONAL EFFICIENCIES: to promote volume growth or sustainability, promote customer satisfaction and improve market share	0.713
SAFETY: Improved safety levels to Reduce/eradicate the number if injuries and fatalities to staff and other port users.	0.791
REGULATORY/ENVIRONMENTAL COMPLIANCE: Contribution to sustainable green port system	0.809
ENTREPRISE RISK: Impact on business if project is not undertaken	0.899
JOB CREATION/ SKILLS DEVELOPMENT: direct project contribution to skills and jobs	0.931
OVERALL ALIGNMENT TO BUSINESS GOALS: strategic fit	0.913

Extraction Method: Principal Component Analysis.

The principal component analysis in table 5.8 indicated that that Kaiser-Meyer-Olkin Measure of Sampling Adequacy was greater than 0.50 indicating that the response measured the attributes of the objective as set out.

In reviewing data correlations with respect to the simplicity and fit for purpose of the model, the correlation between “The model allows objective screening in selecting and prioritizing projects” and “The prioritization model is simple and easy to use” was 0.773. This was a directly related proportionality. Respondents indicated that the simplicity and user friendly application of the model allowed it to be applied to all projects hence ensuring the objective screening in selecting and prioritizing projects. Similarly, the correlation between “Through implementation of the model, projects are selected, prioritised and ranked through an objective, uniform process” and “There is increased stakeholder involvement in project selection by screening port requirements before projects are listed on the corporate plan” was 0.429. This was a directly related proportionality. Respondents

indicated that involvement of the project sponsors as well as the project stakeholders in the screening and selection of projects removed bias from the project selection process.

One of the key objectives in implementing the model was to remove bias from the project selection process. Upon reviewing the data correlations, the correlation between “The principles of project selection and prioritization are applied uniformly irrespective of the size of the project” and “The model allows objective screening in selecting and prioritizing projects” is 0.479. This was a directly related proportionality.

Respondents indicated that objectivity was introduced into the project screening, selection and prioritization process by ensuring that the project selection criteria in the model were applied uniformly across all projects irrespective of the size of the project. This aligned with best practice recommendations by Mohagheghi, Mousavi and Vahdani (2016), Wheeler (2013), Velasquez and Hester (2013). Similarly, the correlation value between “Prioritising projects is likely to improve project delivery by focusing efforts of the business on the 'RIGHT' things” and “Assist ports in becoming more efficient in its operations and services” is 0.378. This was a directly related proportionality. Respondents indicated that port efficiency would be improved by improving capital expenditure on the right capital projects.

In reviewing the data correlations with respect to governance, control and monitoring of the project selection process, the correlation value between “The principles of project selection and prioritization are applied uniformly irrespective of the size of the project” and “Ensure that port infrastructure is reliable and compliant” was 0.540. This was a directly related proportionality. Respondents indicated that the better the principles of project selection, the more reliable and compliant were port infrastructure, and vice versa. Similarly, the correlation value between “There is increased stakeholder involvement in project selection by screening port requirements before projects are listed on the corporate plan” and “The model allows objective screening in selecting and prioritizing projects” was 0.485. This was a directly related proportionality. Respondents indicated that by introducing stakeholder involvement in project selection, the corporate plan would not include wish list projects with minimal strategic relevance hence making it easier to select and prioritize projects.

Table 5.9: Cross tabulation S4.2 before to Job Category

S4.2_before * Please indicate your job category							
Crosstab							
		Please indicate your job category					Total
			Project Management	Project Controls	Engineering	Strategy and Planning	
S4.2_before	Agree	Count	5	2	3	0	13
		% within P	35.7%	22.2%	23.1%	0.0%	28.9%
	Disagree	Count	9	7	10	6	32
		% within P	64.3%	77.8%	76.9%	100.0%	71.1%
Total		Count	14	9	13	6	45
		% within P	100.0%	100.0%	100.0%	100.0%	100.0%
Chi-Square Tests							
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (1-sided)	Exact Sig. (2-sided)	Probability	
Pearson Chi-Square	10.548 ^a	4	0.032	0.029			
Likelihood Ratio	12.275	4	0.015	0.026			
Fisher's Exact Test	8.839			0.044			
Linear-by-Linear Association	.103 ^b	1	0.748	0.795	0.422	0.097	
N of Valid Cases	45						
a. 7 cells (70.0%) have expected count less than 5. The minimum expected count is .87.							
b. The standardized statistic is -.321.							

Table 5.10: Cross tabulation S4.2 after to Job Category

S4.2_after * Please indicate your job category							
Crosstab							
		Please indicate your job category					Total
			Project Management	Project Controls	Engineering	Strategy and Planning	
S4.2_after	Agree	Count	17	4	14	6	46
		% within Pl	100.0%	50.0%	100.0%	100.0%	92.0%
	Disagree	Count	0	4	0	0	4
		% within Pl	0.0%	50.0%	0.0%	0.0%	8.0%
Total		Count	17	8	14	6	50
		% within Pl	100.0%	100.0%	100.0%	100.0%	100.0%
Chi-Square Tests							
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (1-sided)	Exact Sig. (2-sided)	Linear-by-Linear Association	
Pearson Chi-Square	22.826 ^a	4	0.000	0.000			
Likelihood Ratio	16.787	4	0.002	0.000			
Fisher's Exact Test	12.241			0.001			
Linear-by-Linear Association	.555 ^b	1	0.456	0.575	0.306	0.126	
N of Valid Cases	50						
a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is .40.							
b. The standardized statistic is -.745.							

Comparing the p-value in table 5.9 and Table 5.10 between “Projects are ranked and scaled in the corporate plan according to their interdependencies” and “Indicate your job category” was 0.044 before and 0.001 after implementation of the model. This meant that there was a greater statistically significant relationship between these variables in the after scenario. Respondents in certain job categories did believe that projects were being ranked and scaled in the corporate plan according to their interdependencies after implementation of the prioritization model.

Table 5.11: Frequencies of responses for job category before and after

Job Category	Before count	Before %	After Count	After %	Improvement after model (%)
Project management	5	22	17	77	55
Project controls	2	30	4	70	40
engineering	3	18	14	82	64
Strategy & Planning	0	0	6	100	100
Other	3	38	5	62	24

From an analysis of the frequencies of responses in the before and after scenario as shown in table 5.11 above, respondents in all job categories believed that there was an improvement in the ranking and scaling of projects based on project interdependencies after implementation of the model. The agreement was greatest amongst those respondents in the Strategy and Planning job category. The reason for the increase in this job category could possibly be that respondents in this job category are not familiar with project interdependencies in their day to day operations, but had been made aware of the causes and effects through the implementation process and had noticed the improvement after model implementation. From the scoring patterns as well as the results of the degrees of freedom (df), significance and Chi square tests, the opinions of the respondents were demonstrably in favour of

the project selection criteria used to select programmes for infrastructure investment within the Ports Authority. Where there was no consensus or large levels of disagreement within the scoring patterns, recommendations for improvement were discussed in the next chapter.

5.5 Objective 2: To assess if the project selection model guides project selection to align with the Port Authority's strategic objectives

Section 2.1 to 2.6 of the questionnaire tested the effectiveness and ease of use of the project selection model. The questions dealt with a best practice comparison of the project selection model to benchmark the model as a successful tool for project selection, prioritization, ranking and evaluation of capital investment programmes in the Ports Authority context.

Table 5.12: Frequency table summarizing scoring patterns for Objective 2 of the Quantitative Survey

		Strongly Disagree		Disagree		Neither Agree Nor Disagree		Agree		Strongly Agree		Chi Square p-value
		Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	
The prioritization model is simple and easy to use	S2.1	0	0.0 %	3	5.1 %	5	8.5 %	40	67.8 %	11	18.6 %	0.000
The model allows objective screening in selecting and prioritizing projects	S2.2	0	0.0 %	4	6.8 %	7	11.9 %	39	66.1 %	9	15.3 %	0.000
There is increased stakeholder involvement in project selection by screening port requirements before projects are listed on the corporate plan	S2.3	3	5.1 %	3	5.1 %	6	10.2 %	36	61.0 %	11	18.6 %	0.000
Through implementation of the model, projects are selected, prioritised and ranked through an objective, uniform process	S2.4	0	0.0 %	9	15.3 %	7	11.9 %	30	50.8 %	13	22.0 %	0.000
A project selection committee is used in selection and ranking to remove bias in the process	S2.5	1	1.7 %	8	13.8 %	11	19.0 %	29	50.0 %	9	15.5 %	0.000
The principles of project selection and prioritization are applied uniformly irrespective of the size of the project	S2.6	0	0.0 %	3	5.1 %	7	11.9 %	37	62.7 %	12	20.3 %	0.000

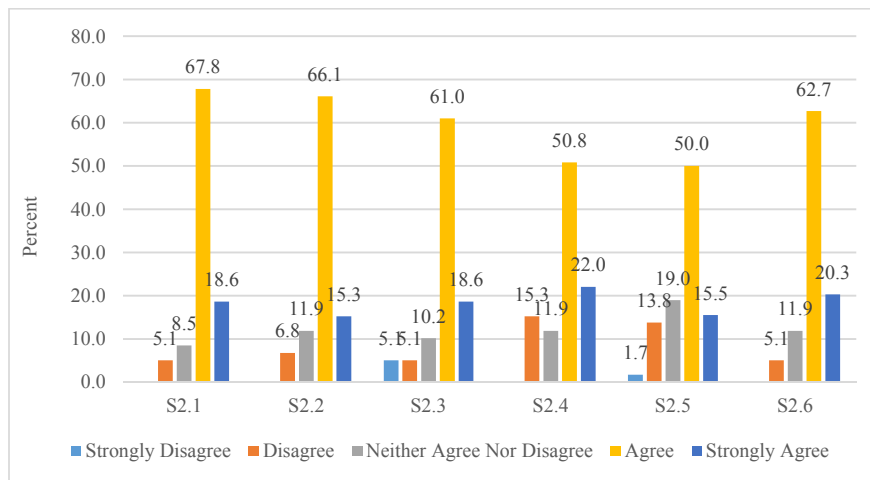


Figure 5.5: Frequency graph summarizing scoring patterns for Objective 2 of the Quantitative Survey

The following patterns were observed in table 5.11 and figure 5.5:

- All of the statements show (significantly) higher levels of agreement with some levels of agreement being lower (but still greater than levels of disagreement)
- There were no statements with higher levels of disagreement
- The significance of the differences was tested and shown in the table 7.6.

It was observed that S2.1, S2.2, S2.3 and S2.6 had higher average levels of agreement than S2.4 and S2.5. The latter two statements relate to ranking of projects whilst the others look at the ease of the implementation of the model. There appeared to be general consensus among respondents that the prioritization model was simple to understand and easy to use. The objective screening in selecting and prioritizing projects and uniform application of the selection criteria, irrespective of the size of the project was also a positive advantage since the principles of project management did not discriminate based on project size or complexity. The respondents strongly agreed that objective screening of projects was being achieved and the project selection model was an improvement from the previous method of project selection which was often subjective, biased and lacked sound business benefit.

There was an obvious improvement in stakeholder involvement during project selection by screening port requirements before projects were listed on the corporate plan. The marked absence of project sponsors and operational staff in project meetings and governance reviews raised repeated concern. These were the individuals responsible for initiating the projects, had clearly identified the need and would be the recipient and users upon implementation and yet they seemed to be disinterested in the progress of the project during execution. The prioritization model required repeated reviews of strategic intent of the project, its business value, current relevance and benefits realization which meant that the sponsors and users were required to take ownership and accountability for the projects. The model also seemed to help the project management team to engage more frequently with the users and sponsors and understand the intended purpose of the project.

The lower levels of agreement in S2.4 and S2.5 could indicate that the respondents were still not convinced that the model would be used as intended. The project sponsors and users may lose interest in the process as time

progresses. The non involvement of these critical personnel could render the selection process fruitless. In that instance, the project team would continue to struggle in justifying business cases for the projects listed on the corporate plan leading to delays and non approvals of capital investment programmes. Hence it was important to develop standard operating practices to ensure that projects were not listed on the corporate plan unless they are supported and defended by users and sponsors.

Table 5.13: Chi Square test results for Objective 2

		Chi-Square	df	Asymp. Sig.
S2.1	The prioritization model is simple and easy to use	59.983	3	0.000
S2.2	The model allows objective screening in selecting and prioritizing projects	54.017	3	0.000
S2.3	There is increased stakeholder involvement in project selection by screening port requirements before projects are listed on the corporate plan	65.661	4	0.000
S2.4	Through implementation of the model, projects are selected, prioritised and ranked through an objective, uniform process	22.288	3	0.000
S2.5	A project selection committee is used in selection and ranking to remove bias in the process	37.517	4	0.000
S2.6	The principles of project selection and prioritization are applied uniformly irrespective of the size of the project	47.508	3	0.000

The highlighted significance values (p-values) on Table 5.13 were less than 0.05 (the level of significance), which implied that the distributions were not similar. That is, the differences between the way respondents scored (agree, neither agree nor disagree, disagree) were significant.

Table 5.14: Principal Component Analysis of Objective 2

Component Matrix ^a	
S2.1 - S2.6	Component 1
The prioritization model is simple and easy to use	0.803
The model allows objective screening in selecting and prioritizing projects	0.788
There is increased stakeholder involvement in project selection by screening port requirements before projects are listed on the corporate plan	0.652
Through implementation of the model, projects are selected, prioritised and ranked through an objective, uniform process	0.713
A project selection committee is used in selection and ranking to remove bias in the process	0.791
The principles of project selection and prioritization are applied uniformly irrespective of the size of the project	0.666

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

The principal component analysis in table 5.14 indicated that that Kaiser-Meyer-Olkin Measure of Sampling Adequacy was greater than 0.50 indicating that the response measured the attributes of the objective as set out.

From the scoring patterns as well as the results of the degrees of freedom (df), significance and Chi square tests, the opinions of the respondents were demonstrably either for or against each of the questions in this section. The respondents appeared to be in favour of the prioritization model with the main concern being that the model would not be used as intended to objectively select and prioritise projects. The researcher addressed this concern as a recommendation for improvement in the model implementation within the organization.

The questions 2.7.1 to 2.7.5 of the questionnaire were designed to ascertain if the project selection model would assist the Ports Authority in boosting revenue to ensure sustainability, stimulating the economy, fulfilling stakeholder requirements ahead of schedule and improving reliability and sustainability of the asset infrastructure. These requirements were directly aligned to the gaps identified in the problem statement. If the project selection model could successfully address these concerns then it would contribute to improved investment decisions.

Table 5.15: Frequency graph summarizing scoring patterns for Objective 2

		Strongly Disagree		Disagree		Neither Agree Nor Disagree		Agree		Strongly Agree		Chi Square
		Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	p-value
Boost TNPA revenue to ensure sustainability;	S2.7.1	0	0.0%	1	1.8%	10	17.5%	38	66.7%	8	14.0%	0.000
Assist with job creation in order to stimulate the economy;	S2.7.2	0	0.0%	1	1.7%	16	27.6%	34	58.6%	7	12.1%	0.000
Assist ports in becoming more efficient in its operations and services;	S2.7.3	2	3.4%	2	3.4%	9	15.5%	34	58.6%	11	19.0%	0.000
Assist TNPA to become more responsive and agile in understanding and fulfilling customer needs;	S2.7.4	0	0.0%	1	1.7%	12	20.7%	32	55.2%	13	22.4%	0.000
Ensure that port infrastructure is reliable and compliant.	S2.7.5	0	0.0%	1	1.7%	7	12.1%	37	63.8%	13	22.4%	0.000

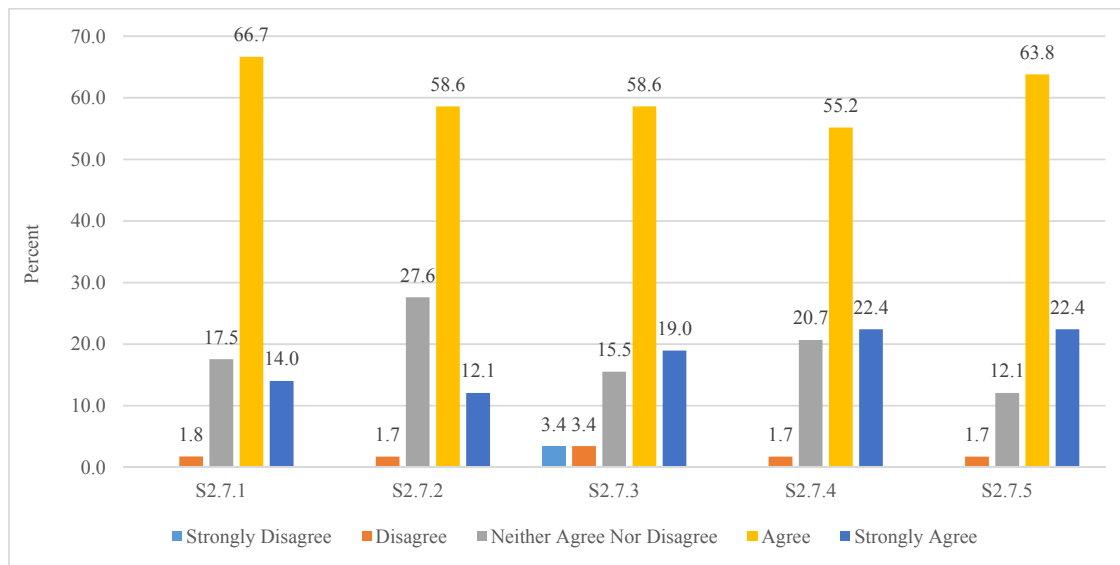


Figure 5.6: Frequency graph summarizing scoring patterns for Objective 2 of Quantitative Survey

Using descriptive statistics, the following patterns were observed in table 5.15 and figure 5.6:

- All of the statements showed (significantly) higher levels of agreement with some levels of agreement being lower (but still greater than levels of disagreement)
- There were no statements with higher levels of disagreement
- The significance of the differences were tested and shown in the table represented by the p-value.

There were generally very strong levels of agreement in this section as well. It was observed that S2.7.1 and S2.7.5 had higher average levels of agreement than S2.7.2, S2.7.3, S2.7.4. The former two statements related to reliability and sustainability whilst the others looked at the responsiveness of the organisation in addressing stakeholder requirements. The strongest level of disagreement was recorded on S2.7.3 which centered around ports becoming more efficient in its operations and services.

The literature review discussed the president's key priorities in the latest State of the Nation Address where the Minister of Finance emphasized the requirement that South Africa should be prioritizing resources towards the infrastructure and development (Gordhan, 2017). There had been tremendous focus of recent past on SOEs having a crucial role to play in advancing economic growth in the development of key infrastructure and manufacturing capacity for South Africa. Infrastructure investments were considered a core part of the accelerated growth strategy. It was therefore of national strategic importance that significant and sustained opportunities for investment were created through Transnet's investment programmes in capital infrastructure development. Employees within the organization had been bombarded with awareness campaigns and media focus calling for a more reliable and sustainable port. To this end, the respondents could be drawing parallels with the role of the prioritization model in aligning the Port Authority's investment programme with the strategic objectives of the organization. The respondents appeared to see the prioritization model as a solution for a nagging problem with far reaching consequences.

On an operational level, employees were starting to relate the lack of investment funds that should be available for capital infrastructure investment, as a direct consequence (in part) to capital funding being used to rehabilitate, refurbish and renovate existing infrastructure because of poor maintenance strategies, historically. These obvious issues, while being only the tip of the iceberg, were serving to build awareness and direct involvement where the organization was being forced to hold culprits accountable for non-delivery in areas of poor maintenance causing existing infrastructure to fail. The concept of COPEX, where capital funding was used to finance operations such as maintenance, was being seen as wasteful and misaligned with the organization's strategic objectives. Hence if the prioritization model could ensure that the right funding sources were applied to the right activities, it would improve sustainability and reliability of the port infrastructure.

In S2.7.3 respondents believed that the model would not entirely enable the responsiveness of the organisation in addressing stakeholder requirements by becoming more efficient in its operations and services. The purpose of the prioritization model aimed to focus on the project selection techniques in planning and infrastructure development at the Ports Authority as an economic stimulus to support faster economic growth in South Africa. The project selection and prioritization model that encompassed the key selection criteria aligned to the Department of Public Enterprises (DPE, 2019), National Development Framework Plan and National Ports Plan (Transnet National Ports Authority, 2019). While important in addressing key economic challenges facing the Ports Authority and South Africa, the model was certainly not the silver bullet to address all the challenges facing the organization at the time as detailed in the Transnet Integrated report of 2018 (Transnet, 2018). Realistically the model could contribute to efficiencies in operations and customer services, however its fundamental purpose was not geared towards these business facets.

To determine whether the scoring patterns per statement were significantly different per option, a chi square test was done as shown in table 5.16. The chi-square test was used to determine whether there was a significant difference between the expected frequencies and the observed frequencies in one or more categories. In this vain, the chi square tests either tested for 'goodness of fit' or 'test of independence'. The null hypothesis claimed that similar numbers of respondents scored across each option for each statement (one statement at a time). The alternate states that there was a significant difference between the levels of agreement and disagreement.

Table 5.16: Chi Square test results for Objective 2

		Chi-Square	df	Asymp. Sig.
S2.7.1	Boost TNPA revenue to ensure sustainability;	55.912	3	0.000
S2.7.2	Assist with job creation in order to stimulate the economy;	42.828	3	0.000
S2.7.3	Assist ports in becoming more efficient in its operations and services;	59.759	4	0.000
S2.7.4	Assist TNPA to become more responsive and agile in understanding and fulfilling customer needs;	34.276	3	0.000
S2.7.5	Ensure that port infrastructure is reliable and compliant.	51.517	3	0.000

The significance values (p-values) in Table 5.16 are less than 0.05 (the level of significance), which implied that the distributions were not similar. That is, the differences between the way respondents scored (agree, neither agree nor disagree, disagree) were significant.

Table 5.17: Principal component analysis of Objective 2

Component Matrix ^a	
S2.7.1 - S2.7.5	Component 1
Boost TNPA revenue to ensure sustainability;	0.829
Assist with job creation in order to stimulate the economy;	0.748
Assist ports in becoming more efficient in its operations and services;	0.715
Assist TNPA to become more responsive and agile in understanding and fulfilling customer needs;	0.821
Ensure that port infrastructure is reliable and compliant.	0.786

Extraction Method: Principal Component Analysis.

a. 1 components extracted.

The principal component analysis in table 5.17 indicated that that Kaiser-Meyer-Olkin Measure of Sampling Adequacy was greater than 0.50 indicating that the response measured the attributes of the objective as set out.

In reviewing the data correlations with respect to strategic alignment of infrastructure development with business strategy, control and monitoring of the project selection process, the correlation value between “Assist TNPA to become more responsive and agile in understanding and fulfilling customer needs” and “Assist with job creation in order to stimulate the economy” was 0.461. This was a directly related proportionality. Respondents indicated that objective screening and prioritization of projects would assist in making the Ports Authority more responsive to customer requirements and in so doing stimulate the South African economy through job creation. Similarly the correlation value between “Improved project delivery will improve investor confidence in NPA (EG Ports Regulator, customers etc.)” and “NPA's investment spending is aligned to its strategic initiatives to support the MDS and volume growth” was 0.398. This was a directly related proportionality. Respondents indicated that after implementation of the project selection and prioritization model, improved project delivery would improve investor confidence and stimulate volume growth. This finding was directly aligned to the recommendations of various authors reviewed under the literature review such as Mohagheghi, Mousavi and Vahdani (2016), Wheeler (2013), Velasquez and Hester (2013).

From the scoring patterns as well as the results of the Chi square tests, the respondents appeared to be in favour of the process of selecting and prioritizing projects with the main concern being that the model may not assist ports in becoming more efficient in its operations and services. For this concern to be addressed the researcher would have to implement operational and customer service solutions beyond the scope of this research.

5.6 Objective 3: To determine whether project selection and prioritization improves investment decision making

Section 3.1 to 3.4 of the questionnaire was designed to test the third study objective of the quantitative research related to strategic alignment of investment decisions. The questions were triggered to ascertain whether or not the model guided project selection to align with Transnet's strategic objectives as defined in the Transnet

integrated report (Transnet, 2019). The infrastructure programme selection must align with the National Ports Plan for infrastructure development and the port tariff application (Transnet National Ports Authority, 2019).

Table 5.18: Frequency graph summarizing scoring patterns for Objective 3 of Quantitative Survey

After Implementation of the Prioritisation Model

		Strongly Disagree		Disagree		Neither Agree Nor Disagree		Agree		Strongly Agree		Chi Square p-value
		Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	
TNPA's investment spending is aligned to its strategic initiatives to support the MDS and volume growth	S3.1	3	5.1%	4	6.8%	13	22.0%	25	42.4%	14	23.7%	0.000
The model requires project objectives to be clearly defined by the Sponsor	S3.2	3	5.1%	1	1.7%	7	11.9%	32	54.2%	16	27.1%	0.000
Prioritising projects is likely to improve project delivery by focusing efforts of the business on the 'RIGHT' things	S3.3	3	5.1%	1	1.7%	5	8.5%	31	52.5%	19	32.2%	0.000
Improved project delivery will improve investor confidence in TNPA (EG Ports Regulator, customers etc)	S3.4	3	5.1%	2	3.4%	3	5.1%	28	47.5%	23	39.0%	0.000

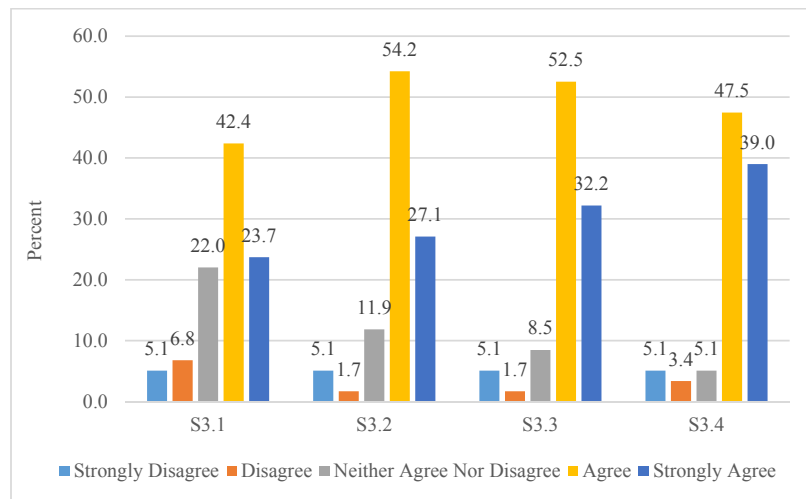


Figure 5.7: Frequency graph summarizing scoring patterns for Objective 3 of Quantitative Survey

Table 5.18 and figure 5.7 show the patterns that emerged from descriptive statistics after implementation of the prioritization model:

- All of the statements showed (significantly) higher levels of agreement for strategic alignment, with some levels of agreement being lower but still greater than levels of disagreement
- There were no statements with higher levels of disagreement

- The significance of the differences was tested and shown in table 8.6.

There were generally very strong levels of agreement that the project selection model improved strategic alignment of investment programmes with the Ports Authority business objectives. It was observed that S3.2 and S3.3 had slightly higher average levels of agreement for strategic alignment than S3.1 and S3.4. The former two statements related to objectives being clearly defined by the Sponsor and prioritization of projects being likely to improve project delivery whilst S3.1 and S3.4 looked at improving strategic alignment and investor confidence.

In the introduction of this thesis the researcher explained the practice for project selection prior to implementation of the model. Each port developed an investment plan or corporate plan per port and that formed the basis of the Ports Authority corporate plan that was also used as the portfolio prioritization plan. Each port should have an investment plan strategically aligned to the growth initiatives in that particular commodity sector with the projects required to facilitate growth and improvement within that sector. The standard project procedures within the PMO clearly outlined the roles and responsibilities of every member of the project team. The project sponsors were intended to manage the optioneering phases of the project, clearly define the business strategy and alignment with project outcomes. The primary aim of the FEL 1 and FEL 2 phases of the project was to select the best or preferred project investment option in line with the Ports Authority business needs and strategy. These initiatives ought to be aligned with the Port Development Framework Plan and the National Ports Plan (Transnet National Ports Authority, 2019). However, owing to the lack of strategic alignment on the corporate plan as well as the subjectivity in the project selection per port (as demonstrated through the qualitative analysis), the corporate plan failed to meet the requirements of a project selection and prioritization model aligned with the strategic objectives of the organization. Within the Ports Authority, the qualitative interviews with subject matter experts had confirmed that the current manner in which projects were either selected or deferred was largely based on available funding or state of readiness for governance approvals. It was possibly for this reason that the respondents were in strong agreement that a business case with clearly defined project objectives would improve project delivery.

S3.1 based on the Ports Authority's investment spending being aligned to its strategic initiatives to support the MDS (Transnet, 2019) and volume growth, showed the strongest levels of disagreement. The model was introduced to respondents in financial year 2018/ 2019. This period may not have been long enough to entrench the benefits of the model into the organization. The corporate plan looked at a 7 year horizon. While the researcher had made concerted efforts to workshop the model, implement in all ports across the Ports Authority and provide feedback at the Capital Approval Committee, the full benefits of the implementation may only become apparent in future years. It may be possible that the respondents believed that this change in behaviour and mind-set of employees would take time and continuous reinforcement before it becomes the new standard operating practice.

To determine whether the scoring patterns per statement were significantly different per option, a chi square test was done. The chi-squared test in table 5.19 was used to determine whether there was a significant difference between the expected frequencies and the observed frequencies in one or more categories. In this vein, the chi square tests either tests for 'goodness of fit' or 'test of independence'.

Table 5.19: Chi Square test results for questions 3.1 to 3.4

		Chi-Square	df	Asymp. Sig.
S3.1	TNPA's investment spending is aligned to its strategic initiatives to support the MDS and volume growth	27.017	4	0.000
S3.2	The model requires project objectives to be clearly defined by the Sponsor	54.475	4	0.000
S3.3	Prioritising projects is likely to improve project delivery by focusing efforts of the business on the 'RIGHT' things	56	4	0.000
S3.4	Improved project delivery will improve investor confidence in TNPA (EG Ports Regulator, customers etc)	54.136	4	0.000

The significance values (p-values) were less than 0.05 (the level of significance), which implied that the distributions were not similar. That is, the differences between the way respondents scored (agree, neither agree nor disagree, disagree) were significant.

From the scoring patterns as well as the results of the Chi square tests, the opinions of the respondents were demonstrably in favour of the project selection model improving strategic alignment within the Ports Authority. In attempting to address the concerns related to S 3.1, there would have to be process improvements relating directly to capital delivery programmes. These may include ensuring that project related specifications are timeously sent to Supply Chain Management (SCM) to trigger applicable SCM processes, addressing capability/capacity issues related to resources and skills gap through project management learnings, removing approval delays and improving turnaround times. The researcher recommended addressing these concerns through training and implementation of targeted solutions in the next chapter.

This section 4 of the quantitative questionnaire tested the third research objective on whether project selection and ranking improved investment decisions.

Table 5.20: Frequency graph summarizing scoring patterns for Objective 3 of Quantitative Survey

Before and After Implementation

		Before				After				Chi Square p-value
		Agree		Disagree		Agree		Disagree		(comparing Agree)
		Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	
Projects are scaled and ranked using uniform criteria	S4.1	12	26.1%	34	73.9%	48	92.3%	4	7.7%	< 0.0001
Projects are ranked and scaled in the corporate plan according to their interdependencies	S4.2	13	28.3%	33	71.7%	46	90.2%	5	9.8%	< 0.0001

Projects in execution phase take priority for funding considerations	S4.3	24	54.5%	20	45.5%	47	94.0%	3	6.0%	0.006
Investment decisions are biased	S4.4	19	39.6%	29	60.4%	33	67.3%	16	32.7%	0.0520
There is misalignment between the project team and the business it serves	S4.5	25	54.3%	21	45.7%	37	75.5%	12	24.5%	0.1280
Standard project management methodology is used effectively on projects	S4.6	18	38.3%	29	61.7%	43	84.3%	8	15.7%	0.001
The project approval and prioritisation processes are aligned to the port development framework plan	S4.7	22	44.9%	27	55.1%	43	87.8%	6	12.2%	0.009
The project governance and quality management processes are well defined and procedurally managed	S4.8	18	35.3%	33	64.7%	39	83.0%	8	17.0%	0.005
The PMO processes are supported by TNPA leadership	S4.9	21	42.9%	28	57.1%	44	88.0%	6	12.0%	0.004
The project reporting process is transparent and consistent	S4.10	19	37.3%	32	62.7%	38	79.2%	10	20.8%	0.012
The business benefits of the project is well defined, measured and monitored	S4.11	19	37.3%	32	62.7%	38	79.2%	10	20.8%	0.012
Project delivery is measured against key performance indicators predefined with stakeholders	S4.12	17	34.0%	33	66.0%	40	81.6%	9	18.4%	0.002

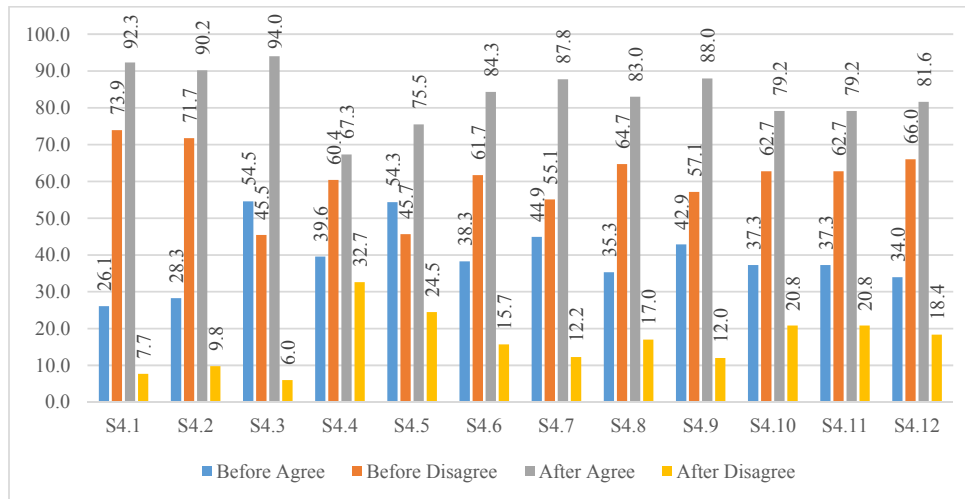


Figure 5.8: Frequency graph summarizing scoring patterns for Objective 3 of Quantitative Survey

All of the statements showed significantly different scoring patterns when comparing before and after, except S4.4 and S4.5 (Table 5.20, Figure 5.8). The levels of agreement for after is greater than that for before. The only significant relationships where the after scoring did not show improvement from the before scoring was for S4.4 and S4.5. In S4.4 where respondents were asked if “Investment decisions are biased”, there appeared to be more agreement that investment decisions were more biased after the implementation of the prioritization model than they were before the model was implemented. However, the frequency table reflects more detail on the scoring analysis where it reflects 39.6% agreement before vs 67.3% agreement after. This clearly showed that 27.7% of respondents agree that that the model had helped to reduce the bias in investment decisions. 60.4% respondents disagreed before while 32.7% of respondents disagreed that investment decisions were biased after implementation of the model. Hence there was a decrease of 27.7% of respondents that disagreed that investment decisions were more biased after the implementation of the prioritization model than they were before the model was implemented.

In S4.5 where respondents were asked if “There was misalignment between the project team and the business it serves”, there appeared to be more agreement of misalignment before the implementation of the prioritization model than there was after the model was implemented. However, the frequency table reflected more detail on the scoring analysis where it reflects 54.3% agreement before vs 75.5.3% agreement after. This clearly showed that 21.2% of respondents believed that there was more misalignment between the project team and the business it serves after the model was implemented. This response was a key concern as the model intended to reduce the misalignment between the project team and project sponsors through objective selection and prioritization of projects using agreed upon criteria that was consistently applied for all investment decisions. The researcher recommended addressing these concerns through training and implementation of targeted solutions in the next chapter.

The table 5.21 and figure 5.9 below represents the processes that respondents believed were not procedurally efficient and well defined.

Figure 5.21: Frequency scoring patterns for procedurally inefficient processes

	Frequency	Percent
project approval and prioritization	45	76.3
risk, issue and dependency management process	43	72.9
project resource management process	43	72.9
business case development	41	69.5
change request management process	37	62.7
communication management process	34	57.6
project performance reporting	33	55.9
project stage gate approval process	33	55.9

(Multiple options were allowed)

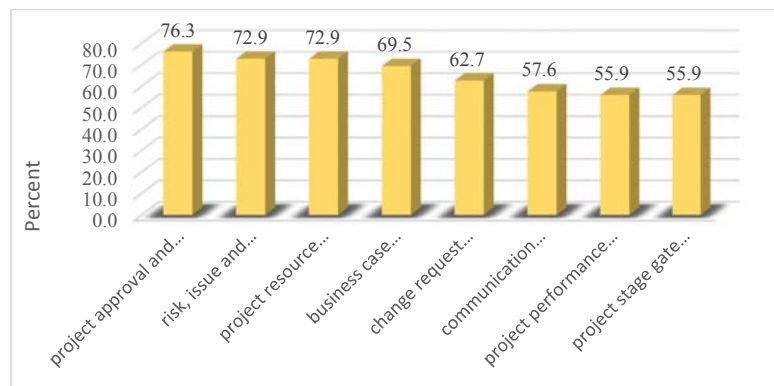


Figure 5.9: Frequency graph summarizing scoring patterns for procedurally inefficient processes

The processes were ranked from highest to lowest. Although none of the scoring was noticeably low, below 50%, the researcher recommended addressing minor concerns through training and implementation of targeted solutions in the next chapter. Emphasis was placed on the lowest ranked concerns being project performance reporting and gate review approval process.

Where the significance values (p-values) were less than 0.05 (the level of significance), results implied that the distributions were not similar. That is, the differences between the way respondents scored (agree, neither agree nor disagree, disagree) were significant. The results of the Chi-square test were included in Appendix 11 of this study. The results indicated that there was no significant relationship for 4.2, 4.3, 4.5, 4.6, 4.7, 4.9, 4.10 and 4.11 before implementation of the project selection model. The results showed that there was a statistically significant relationship for 4.1 to 4.12 after implementation of the model.

Table 5.22: Cross tabulation S4.3 before to Region of Influence

S4.3_before * Region of Influence within TNPA's Project Management Office							
Crosstab							
		Region of Influence within TNPA's Project Management Office				Total	
		Eastern	Central	Western	2 or more		
S4.3_before	Agree	Count	13	2	1	8	24
		% within Region	43.3%	50.0%	100.0%	100.0%	55.8%
	Disagree	Count	17	2	0	0	19
		% within Region	56.7%	50.0%	0.0%	0.0%	44.2%
Total	Count	30	4	1	8	43	
	% within Region	100.0%	100.0%	100.0%	100.0%	100.0%	
Chi-Square Tests							
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Contingency Coefficient	
Pearson Chi-Square	9.075 ^a	3	0.028	0.015			
Likelihood Ratio	12.429	3	0.006	0.008			
Fisher's Exact Test	9.612			0.009			
Linear-by-Linear Association	8.495 ^b	1	0.004	0.003	0.002	0.001	
N of Valid Cases	43						
a. 6 cells (75.0%) have expected count less than 5. The minimum expected count is .44.							
b. The standardized statistic is -2.915.							

The p-value between “Projects in execution phase take priority for funding considerations” and “Region of Influence within PMO” was 0.009 (table 5.22) before implementation of the model. This meant that there was a statistically significant relationship between these variables and respondents believed that projects in the execution phase took priority for funding considerations based on the region of influence of the PMO. The likely reason for this result was possibly that, in the past, the Ports Authority attempted to prioritise projects already contracted or projects in the execution phase when asked to reduce budgets. The main reason for prioritizing projects in execution was to reduce delay damages and claims from contractors where contracts had already been awarded. The prioritization did not extend to interdependent projects which often led to the noble attempts at prioritization becoming fruitless in the execution of programmes of projects. If interdependent projects were not also prioritized, it resulted in delays on the critical path of the prioritized projects and this negatively impacted the overall capital delivery programme. The primary reason for prioritizing projects in the past was the fact that the projects were in execution. There was evaluation done to confirm that projects in execution or projects already contacted were still aligned with the business strategic objectives.

Table 5.23: Cross tabulation S4.4 before to Years of experience

S4.4_before * Indicate your number of years of experience in this role							
Crosstab							
		Indicate your number of years of experience in this role				Total	
			0-6	7-12	13-18	19-24	
S4.4_before	Agree	Count	9	4	6	0	19
		% within In	45.0%	25.0%	75.0%	0.0%	39.6%
	Disagree	Count	11	12	2	4	29
		% within In	55.0%	75.0%	25.0%	100.0%	60.4%
Total		Count	20	16	8	4	48
		% within In	100.0%	100.0%	100.0%	100.0%	100.0%
Chi-Square Tests							
	Value	df	Asymptotic Significance	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Contingency Coefficient	
Pearson Chi-Square	8.485 ^a	3	0.037	0.036			
Likelihood Ratio	9.926	3	0.019	0.033			
Fisher's Exact Test	7.829			0.042			
Linear-by-Linear Association	.188 ^b	1	0.664	0.762	0.393	0.111	
N of Valid Cases	48						
a. 4 cells (50.0%) have expected count less than 5. The minimum expected count is 1.58.							
b. The standardized statistic is .434.							

		Before				After				Chi Square
		Agree		Disagree		Agree		Disagree		p-value
		Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	(comparing Agree)
Investment decisions are biased	S4.4	19	39.6%	29	60.4%	33	67.3%	16	32.7%	0.0520

The p-value between “Investment decisions are biased” and “Indicate your number of years’ experience in this role” was 0.042 (table 5.23) before implementation of the model. This meant that there was a statistically significant relationship between these variables. Respondents with more experience were more likely to see the improvement of removing the bias from investment decisions once the prioritization model was implemented.

Table 5.24: Cross tabulation S4.8 before to Job Category

S4.8_before * Please indicate your job category								
Crosstab								
		Please indicate your job category						
		Project Management	Project Controls	Engineering	Strategy and Planning	Other	Total	
S4.8_before	Agree	Count	2	8	5	0	3	18
		% within PI	15.4%	72.7%	33.3%	0.0%	60.0%	36.0%
	Disagree	Count	11	3	10	6	2	32
		% within PI	84.6%	27.3%	66.7%	100.0%	40.0%	64.0%
Total	Count	13	11	15	6	5	50	
	% within PI	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	
Chi-Square Tests								
	Value	df	Asymptotic Significance	Continuity	2-sided Sig.	1-sided Probability		
Pearson Chi-Square	13.509 ^a	4	0.009	0.007				
Likelihood Ratio	15.463	4	0.004	0.008				
Fisher's Exact Test	12.864			0.008				
Linear-by-Linear Association	.129 ^b	1	0.719	0.733	0.403	0.085		
N of Valid Cases	50							
a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is 1.80.								
b. The standardized statistic is -.359.								

Table 5.25: Cross tabulation S4.8 after to Region of Influence

S4.8_after * Region of Influence within TNPA's Project Management Office							
Crosstab							
		Region of Influence within TNPA's Project Management Office					Total
		Eastern	Central	Western	2 or more	None	
S4.8_after	Agree	Count	29	3	1	6	39
		% within R	93.5%	60.0%	100.0%	75.0%	84.8%
	Disagree	Count	2	2	0	2	7
		% within R	6.5%	40.0%	0.0%	25.0%	15.2%
Total		Count	31	5	1	8	46
		% within R	100.0%	100.0%	100.0%	100.0%	100.0%
Chi-Square Tests							
	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Linear-by-Linear	
Pearson Chi-Square	10.571 ^a	4	0.032	0.041			
Likelihood Ratio	8.676	4	0.070	0.074			
Fisher's Exact Test	9.583			0.026			
Linear-by-Linear Association	4.799 ^b	1	0.028	0.029	0.013		
N of Valid Cases	46						
a. 8 cells (80.0%) have expected count less than 5. The minimum expected count is .15.							
b. The standardized statistic is 2.191.							

		Before				After				Chi Square p-value (comparing Agree)
		Agree		Disagree		Agree		Disagree		
		Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	
The project governance and quality management processes are well defined and procedurally managed	S4.8	18	35.3%	33	64.7%	39	83.0%	8	17.0%	0.005

The p-value between “The project governance and quality management processes were well defined and procedurally managed” and “job category” was 0.008 (table 5.24) while it measured at 0.026 (table 5.25) with “region of influence”. This meant that there was a statistically significant relationship between these variables with 50% increase in agreement after implementation of the model. Respondents saw the value of the prioritization model in removing bias from the project selection process and improving the objectivity, repeatability and standardization in how projects were selected and prioritized irrespective of the size of the project. The insistence on involvement from the project sponsors also closed many gaps in respect of control and monitoring of the project selection process, ensuring that the principles of project selection and prioritization were applied uniformly irrespective of the size of the project ensuring increased stakeholder involvement in project selection by screening port requirements before projects were listed on the corporate plan.

Table 5.26: Cross tabulation S4.12 before to Job Category

S4.12_before * Please indicate your job category							
Crosstab							
		Please indicate your job category					Total
		Project Management	Project Controls	Engineering	Strategy and Planning	Other	
S4.12_before	Agree	Count	3	7	5	0	17
		% within P	23.1%	58.3%	33.3%	0.0%	34.7%
	Disagree	Count	10	5	10	6	32
		% within P	76.9%	41.7%	66.7%	100.0%	65.3%
Total		Count	13	12	15	6	49
		% within P	100.0%	100.0%	100.0%	100.0%	100.0%
Chi-Square Tests							
	Value	df	Asymp. Significance	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Linear-by-Linear	
Pearson Chi-Square	8.287 ^a	4	0.082	0.081			
Likelihood Ratio	10.002	4	0.040	0.061			
Fisher's Exact Test	7.963			0.074			
Linear-by-Linear Association	.000 ^b	1	0.996	1.000	0.545	0.099	
N of Valid Cases	49						
a. 6 cells (60.0%) have expected count less than 5. The minimum expected count is 1.04.							
b. The standardized statistic is -.005.							

		Before				After				Chi Square
		Agree		Disagree		Agree		Disagree		p-value
		Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	(comparing Agree)
The PMO processes are supported by TNPA leadership	S4.9	21	42.9%	28	57.1%	44	88.0%	6	12.0%	0.004
The project reporting process is transparent and consistent	S4.10	19	37.3%	32	62.7%	38	79.2%	10	20.8%	0.012
Project delivery is measured against key performance indicators predefined with stakeholders	S4.12	17	34.0%	33	66.0%	40	81.6%	9	18.4%	0.002

Similarly, there were statistically significant relationships between “The PMO processes are supported by TNPA leadership”, “The project reporting process is transparent and consistent”, “Project delivery is measured against key performance indicators predefined with stakeholders” and “job category” as shown in table 5.26. While the percentage agreement in all three sets of data had shown much greater percentage of agreement after model implementation, the greatest number of respondents in agreement with these statements were almost always in the project controls job category. The reason for this was possibly that the project controls personnel were actively involved in project performance measures, monitoring, control and reporting. These respondents therefore had first-hand knowledge of the measurement impact and improvement on these aspects of the projects after the prioritization model was implemented. Further, there was possibly a higher overall response rate from the project controls participants in the study.

5.7 Hypothesis testing using SEM

Structural equation modeling is often used in hypothesis testing as it illustrates clear definitive, causal relationships between dependent and independent variables in the research (Altikriti and Anderson, 2020:1-13) (Stadler and Hilbert, 2017: 1-20). Structural equation modelling was used to analyse the structural relationship between the measured variables, project selection criteria and project selection model and latent constructs, investment decisions in the study. An additional benefit of the SEM over say, linear regression modelling, was that in creating measures of latent construct, it created increased validity of the measure under study. Multiple related indicators were used in the SEM to comprehensively capture a construct thereby increasing the content validity of the data under analysis. According to Stadler and Hilbert (2017: 1-20), SEM also reduces measurement error which is the most common predictor of bias in the study. In critique, the SEM was characterized as a confirmatory technique rather than an exploratory technique in inferential statistics and was therefore most aptly used in hypothesis testing (Altikriti and Anderson, 2020:1-13). This study compared a second model to the default model to confirm the fit and significance of the results of the original model. The model shown in Figure 5.10 was a multivariate statistical result that was obtained using structural relationships, applying a combination of factor analysis and multiple regression analysis techniques. The measurement model component of SEM created latent constructs from observed variables while the structural model assessed the causal relationships between these variables as indicated by the single and double headed arrows in Figure 5.10 (Altikriti and Anderson, 2020:1-13). The key to the measured and latent variables can be found in the quantitative questionnaire in Appendix 4. For the purposes of the original SEM, using inferential statistics the study aimed to demonstrate the causal relationship of the main components to improved investment decisions (S4.1 - S4.12) identified as the latent variables with the independent or construct variables, project selection criteria (S3.5) and project selection model (S2.1 – 2.6) and (S3.1 – 3.4). AMOS also identified the construct variables as S2, S3 and S2.7.

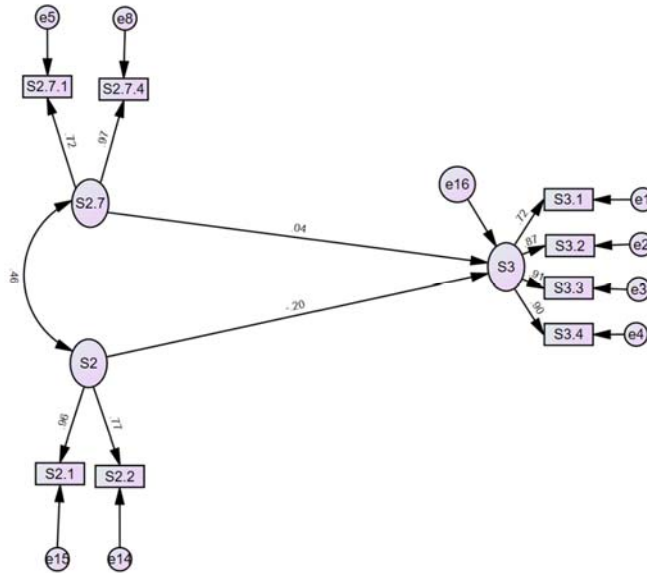


Figure 5.10: original default structural equation model

Path analysis estimated the structural relationships among observed measures (S2, S3 and S2.7) and latent constructs (S4.1 - S4.12). The path diagram is shown in figure 5.10, and the variance indices are explained below. The directional arrows denote relationships between the latent and construct or manifest variables in the study. The curved double headed arrow illustrates covariance between the project selection model (S2, S3) and project selection criteria (S2.7) which are the two construct variables in the hypothesis. Since the project selection criteria was used to construct the project selection model, the relationship was well delineated in the SEM.

Result (Original model)

Minimum was achieved

Chi-square = 25.544

Degrees of freedom = 17

Probability level = .083

This Chi-square tested the null hypothesis that the over identified (reduced) model fit the data as well as does a just-identified (full, saturated) model. In a just-identified model there is a direct path (not through an intervening variable) from each variable to each other variable. In such a model the Chi-square will always have a value of zero, since the fit will always be perfect (Stadler and Hilbert, 2017: 1-20). The probability should not be significant. In this model, the chi square p-value was 0.083, and satisfied the criteria for goodness of fit statistics.

Table 5.27: Regression Weights: Maximum Likelihood Estimates - original model

			Estimate	S.E.	C.R.	P	Label
S3	<---	S2	-.224	.192	-1.169	.242	par_6
S3	<---	S2.7	.061	.274	.223	.823	par_7
S3.1	<---	S3	1.000				

			Estimate	S.E.	C.R.	P	Label
S3.2	<---	S3	1.102	.170	6.467	***	par_1
S3.3	<---	S3	1.156	.172	6.704	***	par_2
S3.4	<---	S3	1.202	.180	6.662	***	par_3
S2.7.1	<---	S2.7	1.000				
S2.7.4	<---	S2.7	1.534	.462	3.322	***	par_4
S2.2	<---	S2	.845	.207	4.076	***	par_5
S2.1	<---	S2	1.000				

Variables that had poor loading coefficients (< 0.60) are indicated in yellow highlight on the standardized weights table 5.27. The interactions of S2 and S2.7 on S3 was not significant. The remaining variables loaded strongly along their various factors (significant p-values). This satisfied the characteristics for goodness of fit between the measured (independent) and latent (dependent) variables. The result indicates that business investment decisions were strongly impacted by project selection criteria and the project selection model.

Table 5.28: Standardized Regression Weights: original model

			Estimate
S3	<---	S2	-.197
S3	<---	S2.7	.036
S3.1	<---	S3	.717
S3.2	<---	S3	.873
S3.3	<---	S3	.907
S3.4	<---	S3	.901
S2.7.1	<---	S2.7	.718
S2.7.4	<---	S2.7	.966
S2.2	<---	S2	.769
S2.1	<---	S2	.964

The parameters were estimated by maximum likelihood (ML) methods in Table 5.28, which was an iterative procedure that attempted to maximize the likelihood that obtained values of the criterion variable would be correctly predicted. It was observed that all but one of the weights were greater than 0.67, except for the latent interactions, which were very poor. The covariance table 5.29 and correlation table 5.30 indicated that there was a significant interaction between the independent variables (S2 and S2.7).

Table 5.29: Covariance: original model

			Estimate	S.E.	C.R.	P	Label
S2	<-->	S2.7	.136	.059	2.293	.022	par_8

Table 5.30: Correlations: original model

	Estimate
S2 <--> S2.7	.460

A separate comparative SEM was shown figure 5.11. The comparison investigated the covariance between the latent variables. The second comparative SEM was merely presented to compare and confirm results indicated in the original SEM model in figure 5.10 since structural equation modelling is a confirmatory technique (Altikriti and Anderson, 2020:1-13). All of the criteria were met for the comparative model in figure 5.11 as well:

Table 5.31: Result (Comparative model)

Chi-square = 27.253

Degrees of freedom = 24

Probability level = .293

CMIN/DF = 1.136

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.914	.838	.989	.977	.988

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.048	.000	.121	.474

These indices were further explained below for the original model.

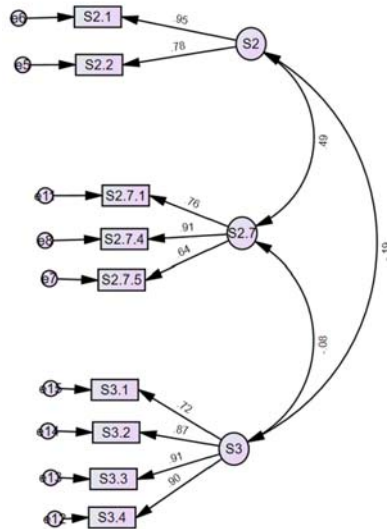


Figure 5.11: Comparative model SEM

According to Altikriti and Anderson (2020:1-13), the suggested acceptable value for relative chi-square, CMIN/DF should not be greater than 5. This value which was used to reduce dependency on the sample size. In the comparative model the CMIN/DF was indicated as 1.136 on table 5.31 which was well below 5 and hence an

acceptable result (Altikriti and Anderson, 2020:1-13). However, the cut-off point for TLI, CFI, NFI and IFI was between zero and one. A good model was indicated by a RMSEA value of less than or equal to 0.08 where the RMSEA was 0.048 in the comparative model.

Table 5.32: CMIN

Model	NPAR	CMIN	DF	P	CMIN/DF
Default model	27	25.544	17	.083	1.503
Saturated model	44	.000	0		
Independence model	8	289.597	36	.000	8.044

CMIN was a Chi-square statistic comparing the tested model and the independence model to the saturated model. The ratio, CMIN/DF, the relative chi-square, was an index of how much the fit of data to the model had been reduced by dropping one or more paths. The CMIN/DF was less than the acceptable value of 5 (1.503) as indicated in Table 5.32.

Table 5.33: Baseline Comparisons

Model	NFI Delta1	RFI rho1	IFI Delta2	TLI rho2	CFI
Default model	.912	.813	.969	.929	.966
Saturated model	1.000		1.000		1.000
Independence model	.000	.000	.000	.000	.000

These goodness of fit indices compared the model to the independence model rather than to the saturated model in table 5.33. The Normed Fit Index (NFI) was simply the difference between the two models' chi-squares divided by the chi-square for the independence model. For this data, the NFI was 0.912, which exceeded the recommended value of 0.9 for a good fit. The Comparative Fit Index (CFI) used a similar approach (with a non-central chi-square) and was said to be a good index for use even with small samples (Altikriti and Anderson, 2020:1-13). It ranged from 0 to 1, like the NFI, and 0.95 (or 0.9 or higher) indicated good fit. The CFI value was 0.966.

Table 5.34: RMSEA

Model	RMSEA	LO 90	HI 90	PCLOSE
Default model	.093	.000	.163	.172
Independence model	.349	.312	.386	.000

The Root Mean Square Error of Approximation (RMSEA) estimated lack of fit compared to the saturated model (Altikriti and Anderson, 2020:1-13). RMSEA of .08 or less indicated an adequate fit. LO 90 and HI 90 were the lower and upper ends of a 90% confidence interval on this estimate. The RMSEA value (0.093) in table 5.34 was marginally greater than the recommended value. Even though the model was somewhat adequate, the PCLOSE p value that tested the null hypothesis that RMSEA was no greater than .05, was not significant, and therefore satisfied the criteria for fit.

In summary, most of the important indices relevant to the model satisfied the conditions required for an adequate model. Hence the SEM proved the hypothesis that there was indeed a causal relationship between the dependent and independent variables in the hypothesis. The deduction was that project selection criteria did have an influence on project selection and prioritization for improved investment decisions at the Ports Authority in South Africa. Various statements were eliminated in the model. An inspection of the coefficients for each latent variable indicated high factor loadings. In addition, the path coefficients were reflected on the diagram. All of the coefficients were high indicating strong positive correlations between the construct and latent variables. As this was a newly developed construct, it was also expected that the structural relationships may not have fitted accurately. However, certain indices were met and it is a recommendation that the model be revised in terms of the measured variables constituting the latent variables to improve factor loadings in future studies.

5.8 Hypothesis testing

The study used the mixed method Sequential Exploratory Design (Creswell and Clark, 2017) to identify the project selection criteria and develop the project selection and prioritization model as an outcome of qualitative analysis as summarised in table 5.35. Thereafter the study used quantitative analysis to test the model in improving investment decisions at the Ports Authority. Using inferential statistics the study aimed to demonstrate the causal relationship of the main components to business success defined as strategic alignment (S3.1 to S3.4) and improved investment decisions (S4.1 to S4.12) with the independent variables, project selection criteria (S3.5) and project selection model (S2.1 – 2.6) and (S3.1 – 3.4). Therefore quantitative and qualitative analysis proved that the results did not occur by chance hence H_0 was rejected. The mixed method analysis therefore triangulated findings from the qualitative and quantitative analysis in proving the hypothesis that project selection criteria does influence project selection and prioritization for improved investment decisions at the Ports Authority in South Africa.

5.8 Chapter summary

In summary, the responses to the quantitative questionnaires were analysed in detail. The feedback received from respondents was analysed in terms of the research objectives. The analysis included reliability statistics, descriptive statistics and inferential statistics to support the interpretation of the quantitative findings. Cross tabulations and correlations were performed against the biographical data for a deeper understanding of respondent's feedback. In almost every instance respondents agreed that there was an improvement in operations after the project prioritization model was implemented. Improvements were indicated in the areas of strategic alignment between business operations and infrastructure development, governance and due diligence, objectivity in screening and prioritising projects and the impact on investment decisions and by extension the Ports Authority customer responsiveness.

The next chapter concludes the study in triangulating the findings from the qualitative and quantitative analysis. The study endeavoured to make meaningful recommendations and implement solutions to address any drawbacks in the implementation of project selection and prioritization within the Ports Authority, in the spirit of continual improvement.

Table 5.35: Hypothesis Testing Results of Mixed Methods Research using Exploratory Sequential Design

Table 5.35: Hypothesis Testing Results of Mixed Methods Research using Exploratory Sequential Design

Research Criteria	Description	Research instrument	Sample size	Response Rate	Test	Research outcome	
						Qualitative	Quantitative
Main objective of the research	To develop a project selection model to support infrastructure investment programmes within the Ports Authority, South Africa	Qualitative semi structured questionnaire; research interviews	20 purposive expert sampling	6 respondents	Qualitative analysis using codes and themes, Lean Six Sigma	identified project selection criteria; developed project selection model	model was tested using quantitative techniques
Objective 1	To identify the project selection criteria to improve project selection and prioritization at the Ports Authority in South Africa	Quantitative questionnaire	75 simple random sampling	58 respondents	reliability, descriptive and inferential statistics	respondents selected criteria guided by best practice	Respondents were demonstrably in favour of the project selection criteria used to select programmes for infrastructure investment within the Ports Authority. Where there was no consensus or large levels of disagreement within the scoring patterns, recommendations for improvement was discussed under recommendations.
Objective 2	To assess if the project selection model guides project selection to align with the Port Authority's strategic objectives	Quantitative questionnaire	75 simple random sampling	58 respondents	reliability, descriptive and inferential statistics		the respondents agreed that the model guided strategic alignment with the organization's objectives.
Objective 3	To determine whether project selection and prioritization improves investment decision making	Quantitative questionnaire	75 simple random sampling	58 respondents	reliability, descriptive and inferential statistics		respondents were in agreement that project selection and prioritization improves investment decision making
Independent variable	project selection criteria	Quantitative questionnaire	75 simple random sampling	58 respondents	Inferential statistics: cross tabulations with chi square, correlation analysis, SEM		covered in analysis of objective 1
Dependent variable	business success	Quantitative questionnaire	75 simple random sampling	58 respondents	Inferential statistics: cross tabulations with chi square, correlation analysis, SEM		covered in analysis of objectives 2 and 3
Hypothesis	Project selection criteria influences project selection and prioritization for business success at the Ports Authority in South Africa	Quantitative questionnaire	75 simple random sampling	58 respondents	Inferential statistics: cross tabulations with chi square, correlation analysis, SEM	used the mixed method Sequential Exploratory Design (Creswell and Clark, 2017) to identify the project selection criteria and develop the model as an outcome of qualitative analysis. Thereafter used quantitative analysis to test the model in improving business success at the Ports Authority	Using inferential statistics the study aimed to demonstrate the causal relationship of the main components to business success i.e. strategic alignment (S3.1 to S3.4) and improved investment decisions (S4.1 to S4.12) with the independent variable, project selection criteria (S3.5).
Triangulated Result	Project selection criteria was identified through the qualitative analysis. The project selection and prioritization model was developed as an outcome of the qualitative analysis. The model was tested using quantitative analysis. Therefore quantitative and qualitative results proved the results did not occur by chance hence H ₀ was rejected. The mixed method analysis therefore triangulated findings in proving the hypothesis that project selection criteria DOES influence project selection and prioritization for improved investment decisions at the Ports Authority in South Africa						

CHAPTER 6

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

The previous chapter discussed the analysis and interpretation of the mixed method research findings. The research methodology was aimed at improving investment decision-making at the Ports Authority, which is a state-owned entity in South Africa. Based on the empirical and theoretical gaps identified in the problem statement, the objective of this study was to develop a project selection model to guide project selection and prioritization of infrastructure investment programmes within the Ports Authority, South Africa.

This chapter triangulates the findings of the qualitative and quantitative research as an outcome of the Exploratory Sequential Design. In addition, the chapter reviews the analysis of the qualitative and quantitative research in line with the research objectives and recommend solutions to address any obstacles be it through changes in processes and procedures, training of staff or recommendations for future research and development.

6.2 Summary of findings

As recommended by Manzoor (2016:1-4), Hodgins (2017:106-376) and Creswell and Clark (2017:67-72), the study design used mixed methods research through exploratory sequential design. The study aim was to identify the project selection criteria and develop the project selection and prioritization model as an outcome of qualitative analysis as summarised in table 5.35. The sub-objectives of this study aimed to identify those quick win project selection criteria aligned to the Ports Authority's strategic objectives in order to select and prioritize projects for execution. By comparison with the recommended international best practice to ensure objectivity and good governance for investment in infrastructure programmes, there was review into the project selection criteria and the project selection modelling that would contribute to sound infrastructure investment decisions at the Ports Authority. The model encompassed the key selection criteria aligned to the Department of Public Enterprises, National Development Framework Plan and Port Strategy. In the past, poor project delivery rendered capital investments as irregular expenditure and eroded confidence in the port's performance resulting in claw backs and tariff adjustments (Havenga, Simpson and Goedhals-Gerber, 2017: 1-13). The net effect of the substantial tariff reductions meant that the Ports Authority had to rely on foreign investment to finance infrastructure programmes. The recent downgrade of South Africa's rating to junk status resulted in an increasing cost of capital to service debt from foreign investments. The cost of capital had to be kept to a minimum to attract private investors (Mchizwa, 2014:1-58).

The first phase of the study was a qualitative exploration of project selection criteria being used to select projects for capital investment and prioritization within each financial year at the Ports Authority. After analysis and interpretation of the qualitative data, the researcher used the recommended project selection

criteria and the existing format of the corporate plan to align with recommendations from best practice and thereby developed a project selection model for capital investment in infrastructure programmes at the Ports Authority. As an outcome of the qualitative research and based on the graphical and statistical analysis of the data using Six Sigma methodologies, the following criteria were identified as root causes for delayed start of projects and subsequent underspending of capital as budgeted on the corporate plan:

- i. Poor project selection was a root cause for the delayed start of projects
- ii. Delayed governance approvals was a root cause for the delayed start of projects.

The sub-objectives of this phase of the study aimed to identify those quick win project selection criteria aligned to the Ports Authority's strategic objectives in order to select and prioritize projects for execution. The study analysed respondent feedback received from the qualitative interviews using semi-structured questionnaires.

The suggested improvements that could be implemented directly by the project management office with minimal input from other departments in the organization are:

- i. Develop a project selection model
- ii. Develop a checklist of items needed before the project seeks approval from a governance committee.
- iii. Develop approval gate pipelines aligned to project schedules
- iv. Operations to investigate strategic fit for project
- v. Ongoing quality audits both internal and external to ensure business benefits realization

The model was implemented over a period of six (6) months before the quantitative research was initiated. The model implementation timeframe was only part of the financial year 2018/2019 but was important in developing a basis for the prioritized infrastructure investment programme that was to be included in the tariff application to the Ports Regulator South Africa. The second quantitative phase followed up on the qualitative phase for the purpose of testing the project selection criteria identified through data analysis of the qualitative research. As an outcome of the triangulated findings of the mixed method research, this study:

- i. Developed a process flow for project selection within the Ports Authority
- ii. Developed a project selection model to support infrastructure investment programmes within the Ports Authority, South Africa
- iii. Developed the instructions to populate the project selection model

The quantitative research tested the effectiveness of the project selection model, in prioritizing an infrastructure programme for capital investment, by using reliability statistics, descriptive statistics and inferential statics to support the interpretation of the quantitative findings and prove the study hypothesis. The data analysis proved the study hypothesis by confirming that project selection criteria did indeed influence project selection and prioritization for business success at the Ports Authority in South Africa.

6.2.1 Objective 1: To identify the project selection criteria to improve project selection and prioritization at the Ports Authority in South Africa

Section 3.5.1 – 3.5.8 of the questionnaire was designed to test the first study objective of the quantitative research defined as an outcome of the qualitative analysis. From the scoring patterns as well as the results of the degrees of freedom (df), significance and Chi square tests, the opinions of the respondents were demonstrably in favour of the project selection criteria used to select programmes for infrastructure investment within the Ports Authority. Where there was no consensus or large levels of disagreement within the scoring patterns, recommendations for improvement are discussed later in this chapter. Revisiting the measures taken to ensure ethical considerations and removal of bias from the process, it seemed valid that responses were a clear indication of the respondents with the project selection criteria used in the project selection model. The fact that most of the respondents seemed to support the project selection criteria gave further credence to its relevance and importance.

6.2.2 Objective 2: To assess if the project selection model guides project selection to align with the Port Authority's strategic objectives

Section 2.1 to 2.6 of the questionnaire tested the effectiveness and ease of use of the project selection model. The questions dealt with a best practice comparison of the project selection model to benchmark the model as a successful tool for project selection, prioritization, ranking and evaluation of capital investment programmes in the Ports Authority context. There appeared to be general consensus among respondents that the prioritization model was simple to understand and easy to use. The objective screening in selecting and prioritizing projects and uniform application of the selection criteria, irrespective of the size of the project was also a positive advantage since the principles of project management did not discriminate based on project size or complexity. The respondents strongly agreed that objective screening of projects was being achieved and the project selection model was an improvement from the previous method of project selection which was often subjective, biased and lacked sound business benefit. There was an obvious improvement in stakeholder involvement during project selection by screening port requirements before projects were listed on the corporate plan.

6.2.3 Objective 3: To determine whether project selection and prioritization improves investment decision making

Section 3.1 to 3.4 of the questionnaire was designed to test the third study objective of the quantitative research related to strategic alignment of investment decisions. The questions were triggered to ascertain whether or not the model guided project selection to align with the Port Authority's strategic objectives as defined in the Transnet integrated report (Transnet, 2019). The infrastructure programme selection must align with the National Ports Plan for infrastructure development and the port tariff application (Transnet National Ports Authority, 2019). There were generally very strong levels of agreement that the project selection model improved strategic alignment of investment programmes with the Ports Authority business objectives. From the scoring patterns as well as the results of the Chi square tests, the opinions of the respondents were demonstrably in favour of the project selection model improving strategic alignment within the Ports Authority. In attempting to address the concerns related to S 3.1, there would

have to be process improvements relating directly to capital delivery programmes. These may include ensuring that project related specifications are timeously sent to Supply Chain Management (SCM) to trigger applicable SCM processes, addressing capability/capacity issues related to resources and skills gap through project management learnings, removing approval delays and improving turnaround times. The researcher recommended addressing these concerns through training and implementation of targeted solutions as discussed in this chapter. Respondents indicated that after implementation of the project selection and prioritization model, improved project delivery would improve investor confidence and stimulate volume growth. This finding was directly aligned to the recommendations of various authors reviewed under the literature review such as Mohagheghi, Mousavi and Vahdani (2016), Wheeler (2013), Velasquez and Hester (2013).

6.2.4 Hypothesis testing

Structural equation modelling (SEM) was used to analyse the structural relationship between the measured variables, project selection criteria and project selection model and latent constructs, investment decisions in the study. Using inferential statistics the study aimed to demonstrate the causal relationship of the main components to improved investment decisions (S4.1 - S4.12) identified as the latent variables with the independent or construct variables, project selection criteria (S3.5) and project selection model (S2.1 – 2.6) and (S3.1 – 3.4). AMOS also identified the construct variables as S2, S3 and S2.7. In summary, most of the important indices relevant to the model satisfied the conditions required for an adequate model. Hence the SEM proved the hypothesis that there was indeed a causal relationship between the dependent and independent variables in the hypothesis. The deduction was that project selection criteria did have an influence on project selection and prioritization for improved investment decisions at the Ports Authority in South Africa. Therefore quantitative and qualitative analysis proved that the results did not occur by chance hence H_0 was rejected. The mixed method analysis therefore triangulated findings from the qualitative and quantitative analysis in proving the hypothesis that project selection criteria does influence project selection and prioritization for improved investment decisions at the Ports Authority in South Africa.

6.3 Conclusion

This study aimed to improve investment decision-making in infrastructure investment programmes at the Ports Authority in South Africa. The mixed method analysis triangulated findings from the qualitative and quantitative analysis in proving the hypothesis that project selection criteria does influence project selection and prioritization for improved investment decisions at the Ports Authority in South Africa. A project selection and prioritization model was developed and benchmarked to international best practice for project selection. The model was successfully implemented at the Ports Authority and was used to interrogate decision-making in capital investments since 2019. Prioritization of investment programmes immediately improved the tariff applications. Once projects were prioritized using the prioritization model, business cases became much simpler to approve since projects were already aligned with the strategic objectives of the business, were categorized and tacitly approved for investment when they were included in the business 10 year investment plan. The faster approval of business cases for capital

investment reduced the governance ‘red tape’ typically considered problematic in state-owned entities such as the Ports Authority (Thomas, 2015: 448-470) (Fowowe, 2017:1-12). This in turn impacted improved project delivery on time and within budget. Resources were focused on the prioritized projects with approved business cases and this immediately started to improve project delivery and organizational efficiency. The Ports Regulator had more confidence in approving a tariff based on tangible performance metrics and approved business cases (Meyiwa and Chasomeris, 2016: 1-20) (Fakir, 2018: 1-58). Increased revenue in the form of tariffs meant more capital availability for infrastructure investments. Project delivery was not weighed down by increasingly expensive cost of capital through debt financing. Hence prioritization of infrastructure programmes for capital investment sought to reduce the cost of doing business with the Ports Authority thereby increasing its competitive advantage, improving investor confidence and satisfying the customer base. The project prioritization model encouraged objective investment decision-making by reducing bias and propensities for self-enrichment and corruption within state-owned entities such as the Ports Authority. The model could easily be applied in other state-owned entities within South Africa, within the rest of the African continent and even globally.

By reviewing the empirical gap in literature this study developed a project selection model that demonstrated how portfolio theory could be enhanced and adapted for state-owned enterprises where the focus was not merely financial returns but also encompassed enterprise risk management, market growth and competitiveness, availability of skilled human capital and providing capacity ahead of demand. This study therefore demonstrated how portfolio theory could be expanded to align with the strategic objectives of the organization as opposed to having purely financial focus and thereby making infrastructure investment decisions more lucrative to all stakeholders at state-owned entities.

6.4 Recommendations

6.4.1 List of improvements recommended by the study

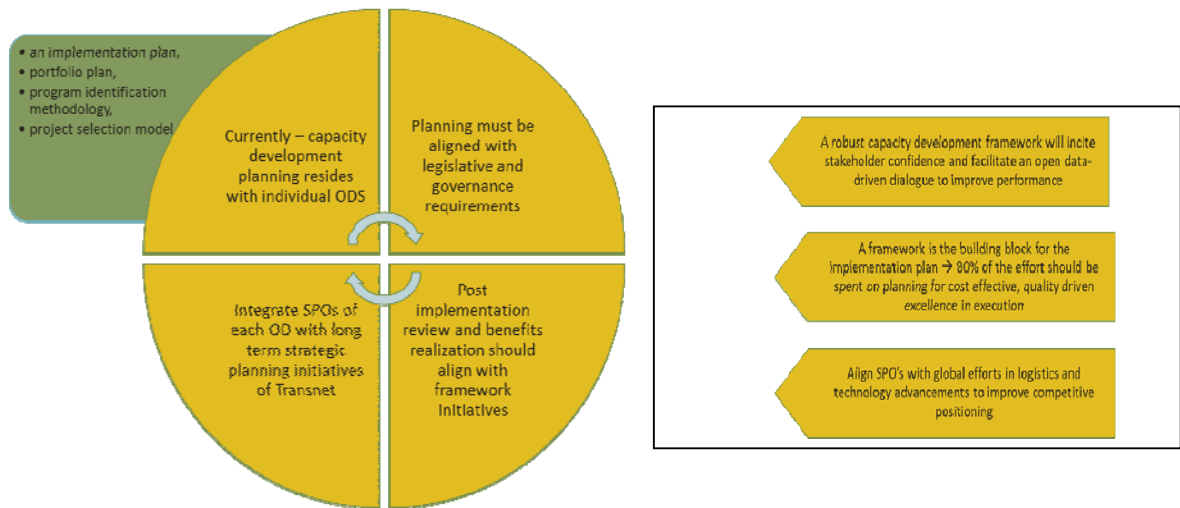


Figure 6.1 – shows the recommendations to address the current capital development challenges as an outcome of this study

Figure 6.1 illustrates the governance process improvements that were recommended to address concerns raised in the quantitative analysis:

- i. Consequence Management when one deviates from the governance process
- ii. Develop a checklist of items needed before one goes to a governance committee for capital approval.
- iii. Develop a business case approval pipeline aligned to project/ programme schedules
- iv. Governance committees must be staffed with adequately skilled resources with multi-disciplinary skills and competencies to review project submissions
- v. Ongoing quality audits both internal and external to ensure business benefits realization

Similarly, the following improvements were recommended to address concerns raised in the qualitative and quantitative analysis (figure 6.1) with respect to optimising capital portfolio for capital investment:

- i. Develop a project selection model
- ii. CAPIC committee preview to support corporate plan
- iii. Develop a tighter process that will ensure proper projects are selected.
- iv. Operations to investigate operational fit for project
- v. ORS must be prepared by business before a project is listed on the corporate plan
- vi. project must demonstrate strategic fit and alignment with port development framework plan
- vii. project sponsor must defend project requirements at governance reviews

By using the Lean Six Sigma (LSS) methodology payoff matrix in table 6.1 and figure 6.2, as recommended by Alexandra and Pinto (2014) as well as Jared (2014), to compare the ease of doing vs the organizational impact through the problem. The improvements ranked with high priority for solution implementation were located in the top left quadrant of the payoff matrix:

- i. Operations to investigate operational fit for project

- ii. governance committees must have multi-disciplinary skills and competencies
- iii. Develop a checklist of items needed before one goes to a governance committee.
- iv. Develop approval gate pipeline aligned to project schedules
- v. ongoing quality audits both internal and external to ensure business benefits realization

Table 6.1: Generating recommendations for improvement

Generating Recommendations for Improvement			
	Project Selection		Governance Processes
1	Develop a project selection model	2	Consequence Management when one deviates from the governance process
3	CAPIT committee preview and sign off to support projects listed on corporate plan	4	Develop a checklist of items needed before one goes to a governance committee.
5	Develop a tighter process that will ensure proper projects are selected.	6	Develop approval gate pipeline aligned to project schedules
7	Operations to investigate operational fit for project	8	Governance committee must be staffed with adequate resources
9	ORS must be prepared by business before a project is listed on the corporate plan	10	governance committees must have multi disciplinary skills and competencies
11	project must demonstrate strategic fit and alignment with port development framework plan	12	ongoing quality audits both internal and external to ensure business benefits realization
13	include in capit resoution that the project sponsor defends the project at the approval committees		

Payoff Matrix			
Ease of Doing	High		
	Low		
	High	6 7 10 12 4	3 13
	Low	1 2 5 8 9	11
		High	Low
		Impact through the problem	

Figure 6.2: Pay off matrix to prioritize recommendations for improvement

6.4.2 Process flow improvements

Based on the analysis of the qualitative data, the project selection criteria was ranked and weighted. In order to implement any improvement within the organization, the PLP process, discussed in the literature review, must be updated, approved and communicated to all employees. An update of the existing capital expenditure approval process for funding of infrastructure projects is therefore recommended to reflect the suggested improvements. The model was reviewed and accepted by various committees within the

Ports Authority prior to approval for implementation i.e. Project Management Office, the Infrastructure and Planning Executive Committee and CAPIC. The criteria listed had been researched, tested and implemented based on various levels of approval within the organisation. The recommended improvements on the process map are shown in green blocks in Figure 6.3.

A summary of the recommended improvements to the process map are as follows:

i. Strategic Alignment:

The implementation of the project selection and prioritization model allowed the Ports Authority to screen projects for strategic fit before including them on the corporate plan i.e. a project that does not align with the strategy of the business will not be listed on the corporate plan. Annual corporate plan clean up sessions are recommended to take place before the Ports Authority prepares the annual PRSA tariff application. Projects that are complete or no longer relevant must not be included in the tariff application.

ii. Gate review:

The study recommended a change in Gate review Terms of Reference to ensure that a multi-disciplinary panel reviewed each PLP submission. To this extent, the organization would have to recruit specialist multi-disciplinary expertise to support the gate review panel

iii. CAPIC approval:

It is recommended to streamline the governance approval process so that only projects that align with the port development framework plans, fleet management plan, precinct plans etc. are listed on the corporate plan for business case approval by CAPIC.

iv. Business benefits realization:

On-going project audits in each FEL phase of the projects will monitor that projects remain relevant and deliver on the business benefits as per the business case.

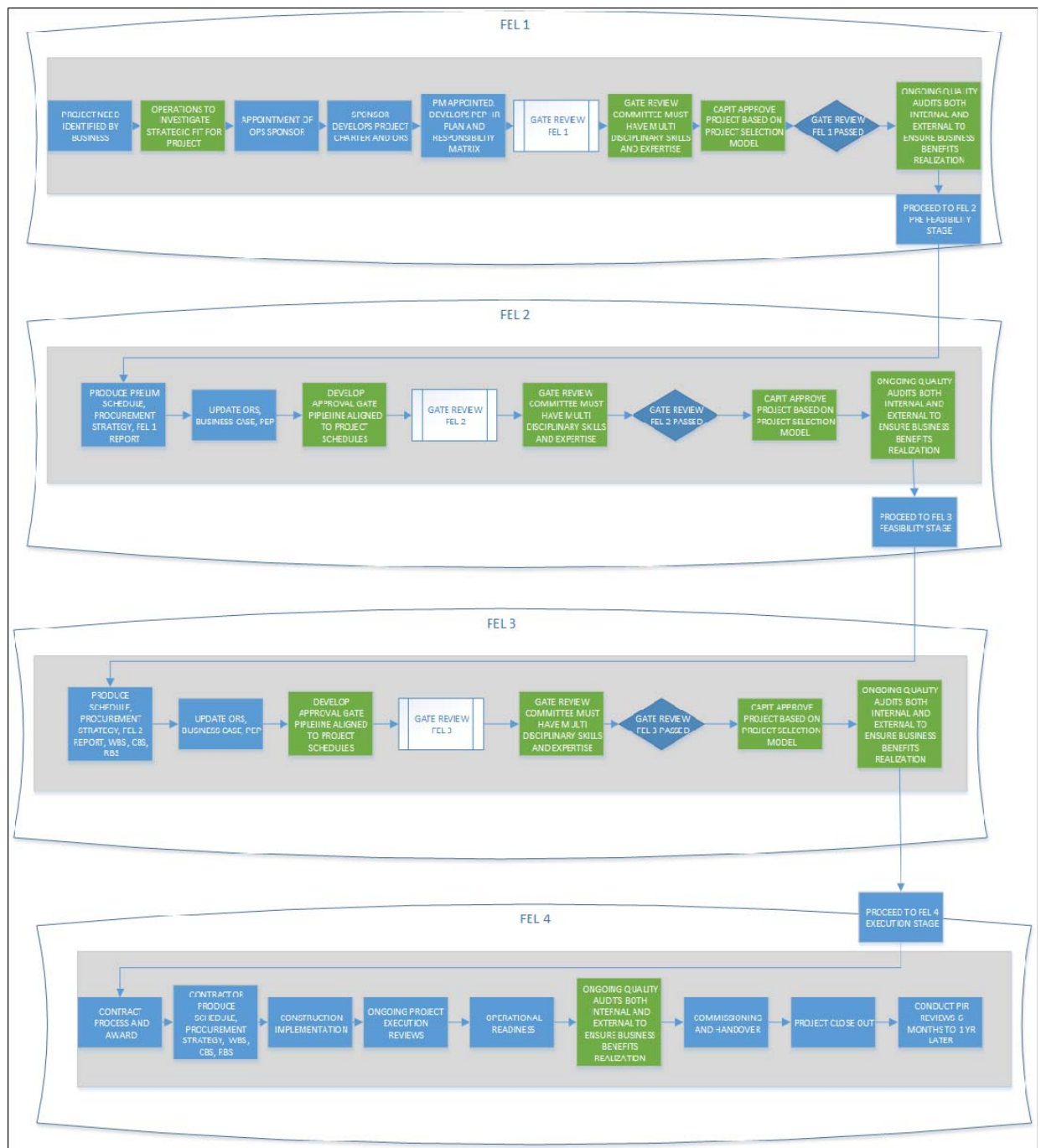


Figure 6.3: Recommendation to improvements to process flow for Capital Expenditure Approval

6.4.3 Performance management

As discussed in the introduction, the state of SOEs in South Africa was a damning indictment on the lack of clear vision and lack of appetite of the ruling political party to unlock the true potential of SOEs to drive growth and job creation within South Africa (Calatayud, Palacin, Mangan, Jackson, Ruiz-Rua, 2016:1-14). With no competition to drive innovation, SOEs were underperforming and required a complete turnaround strategy to rescue and revitalize these parastatals (Ndlozi, 2016: 1-87). While corporate governance theories emphasised virtues of transparency, accountability, honesty, and integrity,

the structure of the state-owned entities within South Africa was mired by complexity in legislation, regulations, changes of government strategic policy orientation and a continually changing economic and political climate (Meyiwa & Chasomeris, 2016). Performance management of projects relies on more than a mere measurement and tracking of project metrics or implementation of earned value management principles. The article by Wentworth and Makokerab (2015: 1-17) discussed blending private financing with public-sector, development finance institutions (DFI) and/or donor (development partner) funding to support public sector funds that were insufficient on their own to provide the necessary levels of financing to achieve the development objectives of the African continent. The recommendation was that private sector participation, build operate transfer (BOT) models and foreign investment would encourage competition, stimulate economic growth and improve corporate governance. A comparable study conducted by Nyamita and Wekesa (2015:1-14) on the public-sector reforms in the Kenyan economy unlocked the opportunities for South Africa to embrace similar debt financing measures to improve efficiency and accountability within the governmental units.

Within the Ports Authority, the qualitative interviews with subject matter experts had confirmed that the current manner in which projects were either selected or deferred was largely based on available funding. According to the Guide to the Project Management Body of Knowledge (PMI, 2017), industries with highly capital intensive projects expended greater time and costs on projects as they progressed through the FEL stage-gate delivery cycle. The corporate plan, in keeping with the concept of project life cycle used the Front End Loading concept, to prioritize the continuity of projects in the FEL 4 execution phase. Shlopak, Emblemssvåg & Oterhals (2014) used a large database of projects to determine a correlation between the quality of front-end development work and project success in terms of cost predictability, cost effectiveness, schedule predictability and schedule effectiveness. The Ports Authority appeared to loosely translate the prioritization of FEL 4 projects to mean that FEL 4 projects were always earmarked for continuity in each financial year irrespective of whether or not those projects were still financially viable, strategically aligned with business goals or with any assessment of the opportunity costs of pursuing those projects over any other projects listed on the corporate plan.

Research conducted by Ngcobo (2016:1-86) expounded on the importance of monitoring and evaluation of project performance using the Earned Value Management (EVM) technique. The Ports Authority was not set up efficiently for Earned Value Management. EVM is the performance management system used to manage quality within the project controls and monitoring spectrum (Ngcobo, 2016: 1-86). EVM is a project reporting tool that enables timely warning to management with respect to project schedules and budgets. EVM principles allow for integration of the scope, cost, schedule and risks on projects by addressing the following questions:

- i. What is the monetary value (Rand) of the work Planned (Budget)?
- ii. What is the monetary value (Rand) of the work Earned (progress)?
- iii. What is the Actual Cost (Rand) of the work Accomplished (Spent)?

EVM is essential for effective project controls where performance is accurately measured while there is still time to take corrective action. For EVM to work effectively on project progress reporting, approved baselined schedules and accurate cash flow forecasts are a crucial recommendation. The requirement from stakeholders was that every project should have at least two EVM indices to indicate performance management e.g. cost performance index (CPI) and schedule performance index (SPI). It is recommended as an outcome of this study that the EVM indices be included in the optimized project selection model so that project performance can be monitored during execution and reviewed post implementation to gauge the true cost benefit of the investment decision.

6.4.3 Risk analysis

The Risk Management process within the Ports Authority was based on the Transnet Enterprise Risk Management (ERM) process and supported by the Risk Management Framework. It involves the achieving of an appropriate balance between realizing opportunities for gains while minimizing adverse impacts. It is an integral part of good management practice and an essential element of good corporate governance. Risk Management is an iterative process consisting of steps that, when undertaken in sequence, enables continuous improvement in decision-making and facilitates continuous improvement in performance. Risks can apply to all levels of an organization or project. Corporate risk is typically reflective of the aggregate of all potentially negative events or opportunities across an entire organization. Corporate risk is most commonly referred to as enterprise-wide risk. Project risk, on the other hand, is defined as the chance of an event happening which would cause the actual project circumstances to differ from those assumed when forecasting project benefits and costs (ISO 31000:2009). These events could have either positive or negative impacts on the project. Using the Lean Six Sigma methodology adapted from Pyzdek, Thomas; Keller and Paul (2014) Failure Modes and Effects Analysis (FMEA) (Table 6.2) is a systematic way of prioritizing risks by assessing the severity, likelihood of occurrence and ability to detect the effects of a failure if the risk materializes. This process was useful to prioritize risks, emerging from the study, that require mitigating actions. There was generally nothing that could be done with respect to the severity of the risk, if it occurred, so the intention was to identify the most critical risks and do something about them. The Risk Priority Number (RPN) was used to identify those risks that pose the greatest threat to the organization. The RPN was a product of the severity of the risk, frequency of occurrence and likelihood of detection. The recommendations, using the failure mode analysis, would be to implement solutions for the risks with the highest RPN numbers as detailed in the key risk elements below.

i. Project Selection Model:

A risk raised through the qualitative and quantitative analysis was that project selection criteria was biased. As per the FMEA, this risk was identified as a potential failure mode. The potential effect of this failure was identified as the possibility for poor project selection. The potential cause if this risk happens is that capital could be invested on the wrong projects resulting in opportunity costs to more business critical projects that are better aligned with the strategic intent of the Ports Authority. The recommended

mitigation would be to develop a standard operating procedure within the organization to ensure that projects will only request capital approval at governance forums within the Ports Authority if the projects had already been selected and assigned a prioritization on the project selection model. The step by step process to populating the project selection model incorporates the standard operating procedures for ranking and selection of projects and had already been approved by various governance forums for implementation within the Ports Authority.

ii. Project Approval:

A further potential failure mode raised through the qualitative and quantitative analysis was the non-approval of projects. This affects the corporate plan for capital expenditure, the planned cash flows and the infrastructure development plans included in the PRSA tariff application. The Ports Regulator South Africa (PRSA) had been reluctant to support port tariff applications from the Ports Authority owing to the non-delivery of infrastructure to defend the annual tariff increase in the past (Fakir, 2018: 1-58) (Havenga, Simpson and Goedhals-Gerber, 2017: 1-13). As an objective of this study, it was identified that the ports required an in-depth analysis to investigate the reasons for non-delivery of infrastructure projects and a practical implementation of recovery models to improve the status quo and the strategies benchmarked to best practice in response to stakeholder concerns. The potential effect of this failure was identified as the project not being approved because key information was missing in the capital approval submission pack. The potential cause of this risk could be a lack of clear communication on project approval requirements. The recommended action to address this failure mode is to develop a submission checklist to improve the quality of project submissions before they are tabled for approval in the first instance. The control could take the form of a checklist, to be submitted to the secretary of the gate review forum to ensure submissions were compliant with approval requirements.

iii. Project Baseline Schedules:

In order to improve the rate of approvals at the governance forums, the requirement was to develop a gate review pipeline aligned to project baselined schedules. The potential failure mode raised was that projects do not have baseline schedules. The potential effect of this failure was that governance approvals could not be scheduled. This resulted in forum members not being available on short notice, meetings were postponed and approvals were delayed, sometimes indefinitely. The potential cause for this risk was poor planning. According to feedback from the risk reduction meetings the Ports Authority needed to recruit planners to fill the skills gap. The recommended action was to recruit additional skilled and experienced planners to complement the project portfolio within the Ports Authority. Planners are to be used to input monthly updates to the business case pipeline that is aligned to project schedules. It was also recommended that a business case pipeline be used to track business case readiness, governance approvals and project cash flow forecasts. In order to approve the project submissions for capital expenditure, the PLP framework (Transnet Intranet, June 2018) requires that project documentation be submitted to the gate review committee at each FEL stage of the project. A potential failure mode was that governance committees must have multi-disciplinary skills and competencies. In the past, gate review panel members were not ideally equipped with multidisciplinary skills and expertise to review and the full content of the project scope.

Table 6.2: Failure Mode Analysis [Source: The Six Sigma Handbook, Fourth Edition (4th Ed.)]

#	Item or Process Step	Potential Failure Mode	Potential Effect(s) of Failure	Severity	Potential Cause(s)	Current Controls	RPN	Recommended Action	Person Responsible
1	Develop approval gate pipeline aligned to project schedules	projects do not have baseline schedules	governance approvals can not be scheduled	8	lack of project planners	over utilization of few inexperienced resources	5	recruit skilled planners	HR training and development
2	Operations to investigate operational fit for project	project selection criteria is biased	poor project selection	8	capital is invested on the wrong things	none	8	develop SPO that projects ranked on project selection model will go to CAPIT for approval	EPMO
3	governance committees must have multi disciplinary skills and competencies	gate review panel members are not identified correctly in terms of their multidisciplinary expertise	submissions are delayed at approval stage	10	lack of understanding of project purpose	over utilization of few inexperienced resources	6	selection of diverse and experience governance approval panel members	CAPIT
4	ongoing quality audits both internal and external to ensure business benefits realization	no quality audits	Quality management is ill defined	6	quality of submissions are comprised resulting in delays at approval stage	poor quality submissions are rejected at governance approval stage	8	audits are ongoing and all non conformances are rectified before project approval stage	Quality Management
5	Develop a checklist of items needed before one goes to a governance committee.	project not approved	project not approved because key information is missing in submission pack	10	lack of clear communication on project approval requirements	submissions that are non-compliant must be redone	5	develop a submission checklist to improve quality of project submissions tabled for approval	EPMO

This led to numerous misunderstandings and queries or clarifications that delayed the approval process unnecessarily. The potential cause was the lack of understanding of the project purpose. As shown in Figure 6.4, 97% of the delays in capital expenditure could be attributed to delays in business case approval at the various governance forums.

iv. Resourcing Governance Committees:

In the past, gate review panel members were over resourced with day to day operations in addition to serving on governance forums. If the business wishes to address resourcing as the biggest reason for delay, the recommended action would be the selection of diverse and experienced governance approval panel members that form part of the dedicated gate review panel members. The Gate review terms of reference were developed to guide the review and requirements process and create clarity for project teams. The terms of reference for the forum must be explicit in stating the roles and responsibilities of each panel member with respect to their area of expertise.

v. Quality Management:

To determine the degree of compliance and effective control of the Standard Project Protocol Document, the Project Life-cycle Processes (PLP), Integrated Capital Projects Assurance Framework and Procurement Policy Manual, it is recommended that ongoing quality audits be carried out both internally and externally for the Ports Authority. The potential failure mode was identified as there being a lack of quality audits. The potential effect of the failure was that quality management was ill-defined with very little clear distinction between quality assurance and quality control. The potential cause was the poor quality of project PLP submissions resulting in capital approval delays. The recommended action is for audits to be ongoing and all non-conformances to be rectified before project approval stage. Quality audit schedules and project conformance checklists must be developed to facilitate ongoing quality audits to ensure business benefits realization. Non-conformance reports must be issued to the project manager to implement the corrective and preventive actions.

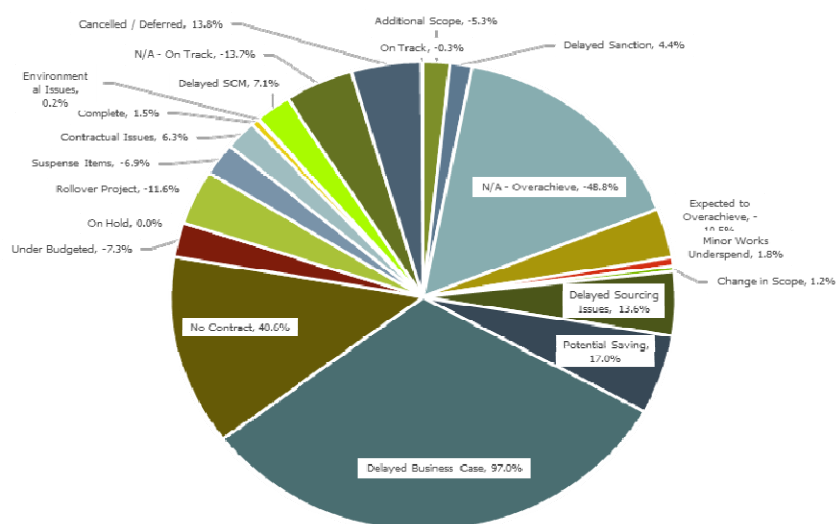


Figure 6.4: Pie Chart Analysis of the root causes for delays in capital approval at the Ports Authority

6.4.5 Process capability and control

CAPEX underspend is the shortfall between the planned and actual capital budgets for infrastructure projects. Delay in spending funds budgeted for capital infrastructure projects resulted in loss of investor confidence and loss in customer base as the infrastructure was not available when required. Reducing delays in approval for the start of capital infrastructure project approval at the Ports Authority benefits the organisation in delivering infrastructure on time and within budget. As recommended by Alexandra and Pinto (2014: 1-10) as well as Jared (2014: 1-3), the Six Sigma methodology was applied to the problem of CAPEX under expenditure with the goal to reduce the turnaround time for FEL 3 capital infrastructure project approval at the Ports Authority from 26 months to 12 months by October 2018 as shown in Appendix 12. For the purpose of measuring the impact of change, the scope included projects listed on the corporate plan in the 18/19 financial year for the Port of Durban only. Projects for all other financial years in any other port within the Ports Authority fell out of the scope of this Six Sigma project. In order to calculate the potential project benefit it was important to consider all the financial aspects and identify all the potential benefits, but also the potential costs. There were no hard benefits identified for this project. Table 6.3 lists the soft benefits defined for the project. Soft benefits do not lead to immediate or measurable financial income, but were efficiency improvements that freed up resources to be redeployed for other purposes, thereby giving an indirect benefit.

To guard against lofty goals that are often unachievable, the project metrics targeted a 10% improvement on the turnaround time for project capital funding approvals. As shown in Table 6.4, the primary metric required a reduction in the turnaround time for FEL 3 capital infrastructure project approval from a baseline metric of 26 months to a projected metric of 12 months while the secondary metric required a 10% improvement in the number of capital projects completed on time from a baseline of 40% to a projected 50% projects completed on schedule.

Table 6.3: Soft benefits defined for Six Sigma project

Soft Benefits

Description	Baseline Amount	Actual Amount	Comments / Reasons
Improve infrastructure delivery at TNPA Port of Durban	Actual as per corporate plan	Planned as per corporate plan	
Improve investor confidence	low	high	

Table 6.4: Project Metrics defined for the Six Sigma project

Project Metrics	Description	Baseline Metric	Projected Metric
Primary Metrics	Reduce the turnaround time for FEL 3 capital infrastructure	26 MONTHS	12 MONTHS
Secondary Metrics	Number of capital projects completed on time.	40% on time completion of projects.	50% on time completion of capital projects
Consequential	No additional capital funds	As per signed off fund plan	As per signed off fund plan

Based on a target of no more than 10 months delay and comparing the process capability before and after the Six Sigma project was implemented (figure 6.5 and figure 6.6), it was clear that the project selection model that was implemented within the Ports Authority (albeit over a short duration of only 6 months at the time of this recommendation) had made an improvement in reducing the project capital approval delays. A measurement of performance greater than the upper limit revealed 151 000 defects improvement while the potential capability also improved from -0.23 to -0.16. As indicated by the results of the Six Sigma project, while the process was still not capable in terms of realising the project goal and the objectives of this study, improvements had been made. The recommendations indicated in this chapter would greatly improve the process capability.

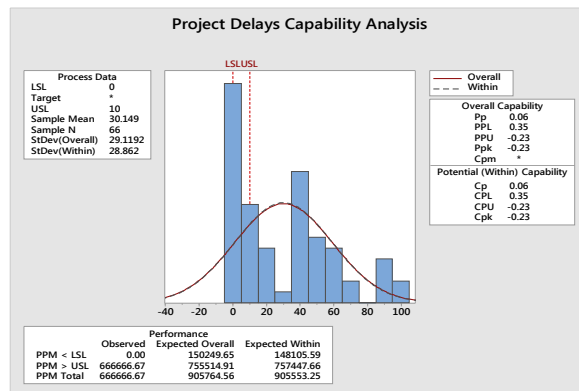


Figure 6.5: Histogram, Project Delays Capability Analysis (Before) using Six Sigma

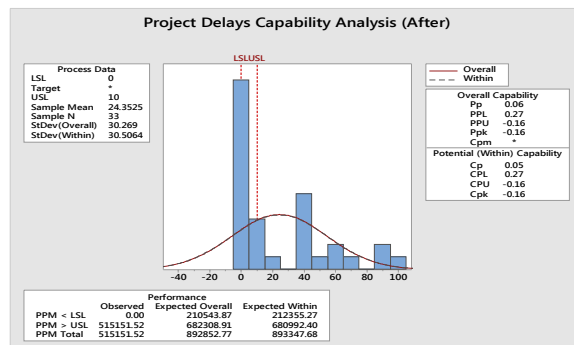


Figure 6.6: Histogram, Project Delays Capability Analysis (After) using Six Sigma

6.4.6 Training plan

By implementing the investment model for prioritization of capital infrastructure programmes, the organisation was thrust into a stronger competitive position within the industry. Wherever new procedures or processes are implemented it is recommended that employees receive the necessary training to build awareness of the proper procedures to follow and to build employee confidence in incorporating new practices into the execution of daily tasks. It is recommended that training workshops be conducted at each of the eight ports within the Ports Authority to effectively use the project selection model. Chapter 6.4 of this study detailed a standard operating practice to populate the project selection

model. The training will develop expertise within the organization on how to select projects for operational fit, categorise, rank and scale projects according to the project selection criteria. The process for moderation of scores by the EPMO as well as the process for approval of projects thereafter were clearly documented in the instructions to populate the project selection model (chapter 6.4) and it is recommended that all employees within the capital approval process be trained on the new processes. In order to entrench the learning, it is recommended that these training workshops be held annually for at least the next 3 years until the Ports Authority is aligned to the project planning horizon and approved business case requirements of the PRSA.

6.4.7 Recommendations for solution monitoring

To control and monitor the implemented solutions for sustained benefit to the organisation, a monitoring plan (Table 6.5) and the response plan (Table 6.6) was developed using the Six Sigma process methodology as recommended by Alexandra and Pinto (2014: 1-10). The monitoring plan details what process steps need to be monitored, frequency of monitoring, assigns responsibility to monitor and outlines the trigger for review. Control measures are implemented on the inputs while the outputs are only monitored (Alexandra and Pinto, 2014: 1-10).

While the project team may be eager to adjust minor deviations to maintain the benefits of the solutions that have been implemented, small variations can be tolerated in some instances. Unnecessary changes could render the solution invalid. The response plan is explicit in detailing when and how to respond to triggers and when to leave it alone.

Table 6.5: Monitoring Plan

Item	What step/input needs to be monitored?	Who will monitor it?	How Often and When	Trigger of Review
1	Review readiness of business case for CAPEX approval, strategic alignment, project dependencies	PMO & EPMO	Every quarter for monitoring and Annually for inclusion in tariff application	business case not ready for CAPEX approval
2	PLP scaling	GCIA	per phase	governance processes are too onerous Adequacy of budget, resources,
3	readiness of PLP submissions for gate review, investment forum and CAPIC approval	PMO & EPMO	monthly updates	delays on gate review schedule
4	quality assurance, quality control, post implementation review, operational readiness	QUALITY MANAGEMENT	quarterly - ad hoc	quality non conformances

i. Trigger 1 - Business Case Not Ready:

The business case readiness had been identified as a root cause for delays in capital expenditure. When the business case is not ready on or before the planned date for governance approval, it is recommended that either the PMO or the EPMO immediately prepare the project recovery plan to address schedule slippage, alternatively identify other quick win projects that could be fast tracked to replace the delayed project in the instance when schedule recovery is not possible or prepare for project deferral (possibly to the next financial year) thus releasing committed funding for other projects. The CAPIC committee needs

to be made aware of the possible underspend of planned capital expenditure on the corporate plan and to approve reprioritization plans.

ii. Trigger 2 – PLP Scaling:

Projects are scaled for size and complexity against the PLP scalability model. An incorrect scaling can become a resource burden on a project where extraneous governance and due diligence procedures are applied. This affects the human resource allocations, may increase the budget and delay the schedule rendering the project financially non-viable. An incorrect scaling could be a result of poorly defined project metrics and project scope. When this happens, it is recommended that the project manager request a re-scaling of the project based on the redefined scope, cost, schedule and quality objectives of the project.

iii. Trigger 3 – Delays caused by Governance:

The business case readiness had been identified as a root cause for delays in capital expenditure. In instances where the governance committees cannot assemble a forum as per the terms of reference or when project submissions are not approved on repeated submissions, it is recommended that either the PMO or the EPMO immediately prepare the project recovery plan to address schedule slippage, identify other quick win projects that could be fast tracked to replace this one in the instance when schedule recovery is not possible or prepare for project deferral (possibly to the next financial year) thus releasing committed funding for other projects. The CAPIC committee need to be made aware of the possible underspend of planned capital expenditure on the corporate plan and to approve reprioritization plans.

Table 6.6: Response plan

Item	Input	Spec Limit/Trigger	How to react	Trigger to Escalate	How to escalate	Sustainable
1	Review readiness of business case for CAPEX approval, strategic alignment, project dependencies	Business case not ready for CAPEX approval	Project recovery plan, quick wins, project deferral	Underspend on corporate plan	Capital approval committee	PMO & EPMO
2	PLP scaling	Governance processes are too onerous, Adequacy of budget, resources, schedule	Review outliers against scalability model criteria	Redefine project scope, cost, schedule requirements	Project sponsor & and stakeholder engagement	GCIA
3	Readiness of PLP submissions for gate review, investment forum and CAPIC approval	Delays on gate review schedule	Project recovery plan, quick wins, project deferral	Underspend on corporate plan	Capital approval committee	PMO & EPMO
4	Quality assurance, quality control, post implementation review, operational readiness	Quality non conformances	Quality audit	Quality defects	Project issue and risk register	GCIA

iv. Trigger 4 – Quality Non Conformances:

The purpose of quality management is to ensure that the project quality objectives and stakeholder expectations are met and to ensure that the products and services provided conform to the project quality objectives. The satisfaction of the project stakeholders greatly depends on the application of quality guidelines during the planning and execution of the project deliverables. Quality non-conformances, if

not addressed, could have far reaching consequences in detrimentally affecting project deliverables, escalating risks, increasing cost and schedule. It is recommended that quality audits be used to identify non-conformances. Quality defects must be escalated to the quality assurance officer to ensure that the quality activities are carried out according to the Quality Management plan, authorise preventive and corrective change requests and negotiate concessions or trade-offs that result from quality variances with the project stakeholders.

6.5 New knowledge contributions

According to Khambholiya (2020:1-14), Markowitz developed portfolio theory in 1995. In the earlier Markowitz portfolio selection models, the emphasis was on risk diversification to strengthen financial investments. The models focused on financial indices only. Since then, there have been several iterations of the Markowitz model as well as other research findings on similar portfolio selection models. These were discussed earlier under the theoretical review of multi criteria decision making models. A study by Silver (2019:1-7) showed that stakeholder wealth maximization was more encompassing than financial performance metrics. Silver stated that since the shareholder was only a component of the portfolio stakeholders, other stakeholder requirements such as regulatory compliance, job creation, safety and health requirements, operational efficiencies and capacity creation were also of fundamental importance to creating wealth for stakeholders. An article by Sepehri (2013:1-10) stated that companies that evaluated projects by estimating impacts on cash flows and financial metrics alone ignored a significant component of the value derived from the project. Silver (2019:1-7) also suggested that by merely looking at the financial indices, the organization was likely to invest in portfolios that did not improve organizational competitiveness, create a safe, compliant working environment or promote sustainability. The project selection criteria identified in this study demonstrated strategic alignment with organizational objectives in order to improve business investment decisions. A project selection model was a proven technique employed in a structured and objective approach to guide decision making in balancing the needs of the business with those of the customers and stakeholders (Gosenheimer, 2012:1-8). The best projects are the projects that create the most value to the organization (Rose, 2013:3) (Singh, 2019:1-6). This study developed a project selection model that demonstrated how portfolio theory could be enhanced and adapted for state-owned enterprises such as the, Ports Authority, where the focus was not merely financial returns but also encompassed enterprise risk management, market growth and competitiveness, availability of skilled human capital and providing capacity ahead of demand. This study therefore demonstrated how portfolio theory could be adapted to align with the strategic objectives of the organization selecting project selection criteria contextual appropriate for the organization. The project selection criteria is then used to guide project selection and prioritization as opposed to having purely financial focus and thereby making infrastructure investment decisions more lucrative to all stakeholders and aligned to the strategic objectives of the organization.

The empirical review of literature recommended that project selection should be a systematic, objective process with an aim of producing prioritized project alternatives so as to facilitate informed decision making on the choice of the most viable projects to pursue. Hence this research identified project

selection criteria before developing a project selection model to improve investment decision-making in investment programmes at the Ports Authority. This study aimed to show that projects could be selected for inter-relationships, interdependencies and support of business objectives and remain viable even if they do not contribute directly to the business bottom line. The AHP was recommended as the preferred approach for project selection and this study used the AHP theoretical framework in the assessment of priority scales for project selection criteria. The priority scales recommended through the AHP method will close the gaps for selecting, prioritising and validating project selection and prioritization within the Ports Authority.

6.6 Limitations of the study

The researcher implemented the prioritization model for the selection, ranking and prioritization of capital investment projects in the FEL 3 and FEL 4 execution phase. The study assumed that due diligence was applied in the conceptual and initiation phases of projects (FEL 0, FEL 1 and FEL 2). The draw back to this assumption is that organisations, such as the Ports Authority, often expend vast resources in terms of time, money and personnel in extensive conceptualizing of projects without carefully applying the selection and prioritization techniques recommended in this research. Once the assessment of project options is complete and the project is ready to progress into execution, SOEs are remiss to defer or cancel these projects owing to the cost of resources already expended on the project. The challenge is that without clear performance metrics and project selection criteria any expenditure that is irregular or, fruitlessly and wastefully employed is deemed a PFMA violation as per Public Finance Management (Act No 1 of 1999 Government Gazette 40637). Hence these projects naturally progress to execution at the opportunity cost of projects and programmes that may have had superior strategic alignment with the business intent. A similar model can be implemented for the FEL0, FEL 1 and FEL 2 phases of projects which typically use operational expenditure funds.

6.7 Recommendations for future research

The first recommendation would be to develop a similar project prioritization model that can be implemented for the FEL 1 and FEL 2 phases of projects to ensure strategic alignment of the Port Development Framework Plans, Fleet Plans and Precinct Plans. The advantage of the selection model in the initiation and pre-feasibility phases of the project will provide a ‘cradle to grave’ approach in driving capital expenditure in line with the strategic objectives of the organisation.

This research looked at selection and prioritisation of projects with consideration of all interdependencies amongst projects. A similar model can be used for the selection and prioritization of programmes and/ or portfolios of projects at a macroscopic level. This would give organisations a huge advantage in long term planning for capital investment in infrastructure development.

This research culminated in a model that requires manual inputs since this was a pilot implementation for the PMO at the Ports Authority which is at a relatively low maturity level as defined by the PMBOK

(PMBOK Guide, 2004). As the organisation becomes more confident with the application of the model, an added advantage would be to automate the model so it is more user friendly. Similarly the model can be extended for implementation in other divisions of Transnet as well as in other State-owned Enterprises as well as in private sector. The project selection criteria would have to be adapted for contextual application.

6.8 Chapter summary

The context for this research evolved due to the strained economic conditions in South Africa placing State-owned Entities (SOEs) under severe pressure to fund capital programmes (Gordhan, 2017). South Africa was downgraded to below investment grade (junk status) by both Standard and Poor (S&P) and Fitch ratings agencies (Transnet, 2018). The cost of funding was expected to increase for State-owned Entities (SOEs) thereby making it increasingly difficult to secure infrastructure investment funding. A further challenge in the governance of port pricing and competitiveness resulted in the Ports Regulator South Africa rejecting the tariff application from NPA in 2018/19 (Fakir, 2018: 1-58) (PRSA, 2019). In the past, the majority of the infrastructure development projects in parastatals was driven by pressure from investors to deliver returns on investment and not by opportunities for growth and expansion (Nkiwane et al, 2016).

To this end the Ports Authority required an in-depth analysis to investigate the reasons for non-delivery of infrastructure projects. The objective of this study was to develop a project selection model to support infrastructure investment programmes within the Ports Authority, South Africa. The sub- objectives of this study aimed to identify those quick win project selection criteria aligned to the Ports Authority's strategic objectives in order to select and prioritize projects for execution. To achieve this, the researcher aimed to benchmark the current practice against the best practice in relation to the selection, ranking and prioritization of projects in Transnet, a State-owned Entity; and also identify the key contributors in project selection and decision making within the Ports Authority.

The recommended study design was a mixed methods research through exploratory sequential design (Creswell and Clark, 2017:6-28). A project selection model was developed and implemented based on the weighting and ranking of project selection criteria determined as an outcome of the qualitative research. Quantitative research was conducted least 5 months after implementation of the project selection and prioritization model to test the model's responsiveness in the selection, ranking and prioritization of projects at the Ports Authority. This chapter summarised the findings of the mixed method research per study objective. The hypothesis was proved by triangulating the findings of the qualitative and quantitative research. Recommendations were made to close the gaps identified by the study. Recommendations were made based on the study outcomes by using the Lean Six Sigma (LSS) methodology payoff matrix to compare the ease of doing vs the organizational impact through the problem, as recommended by Alexandra and Pinto (2014) as well as Jared (2014). Monitoring and

response plans were proposed to guide the organisation on when and how to respond to or escalate triggers as identified.

APPENDICES

Appendix No.	Title
1	Qualitative questionnaire
2	Interview transcripts for Qualitative Research
3	Informed Consent
4	Quantitative questionnaire
5	Process flow for project screening & prioritization
6	Process flow for strategic fit
7	Criteria for ranking projects
8	Process flow for project ranking
9	Regulator tariff application criteria
10	Correlations from Quantitative Analysis
11	Chi square tests from Quantitative Analysis
12	Six Sigma Project Charter
13	Ethical Clearance Certificate UKZN
14	Change of title
15	Turnitin Report

APPENDIX 1

INTERVIEW SCHEDULE FOR CAPEX APPROVAL TEAM

Name of Interviewee	
Date of the Interview	
Place of the Interview	

1. Key Challenges with project delivery in South Africa
In this section, the interviewer aims to identify the current challenges (if any) with project delivery in National Ports Authority

1.1 In your opinion, does Infrastructure development in your organization impact the South African Economy

1.2 What would you list as the principle reasons for non-delivery of infrastructure in your organization

1.3 Is there a problem to secure capital funding for infrastructure development projects?

1.4 Do you believe that your organization are losing investor confidence? If yes, why do think this is happening

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1.5 Would you say that there is more project failure or project success in terms of the meeting the time, cost, scope and quality objectives of the project? Why?

2. Investment Decision making in State Owned Enterprises

The aim of this section is to explore investment decision making in state owned companies within South African ports in comparison to other international ports.

2.1 What would you cite as the reasons that the Ports Regulator South Africa rejected your organization's first tariff application in 2017?

2.2 Is the port development framework plan aligned to the organization's business strategy?

2.3 Are the organization's objectives aligned to the Port Tariff Methodology for investment in infrastructure?

3. Project Management best practices in Southern Africa

In this section, the interviewer intends to identify the contributors to project selection and prioritization by reviewing the port objectives against the port tariff methodology and aligning them to the prioritization of infrastructure in South African ports.

3.1 Is capital being spent on the right projects within your organization?

3.2 What is the current process of selecting projects for the corporate plan in your organization?

3.3 Do you believe that projects are selected using objective selection criteria

3.4 In your opinion, is the manner of selecting and deferring projects in your organization aligned with best practices of other SOEs in the port environment

3.5 What would you regard as best practice in project selection within SOE's such as your organization?

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3.6 Do you believe that your organization follows best practice in project selection?

3.7 What does the organization do to facilitate good practice in project selection and what are the threats to this process?

3.8 What are the barriers to providing objective project selection in your organization?

3.9 Can you recommend tools and techniques to improve project selection in developing the corporate plan?

3.10 Rate the following criteria in order of importance in project selection on a scale from 1-8 where 1 is the most important and 8 is the least important criterion in project selection.

Criteria for project Selection	Rating
<i>If projects were to be ranked and scaled using uniform criteria in your organisation, how would you rank the following project selection criteria? Rate the criteria below on a scale from 1-10 where 1 is the highest rank and 10 is the lowest rank of prioritization.</i>	
FINANCE AND FUNDING: revenue growth, financial viability (NPV, IRR etc)	
CAPACITY CREATION: Maintain adequate, reliable port Infrastructure and Fleet. Increase infrastructure/ Fleet capacity and/ or support/promote market growth Promote optimized land use	
QUANTIFIABLE OPERATIONAL EFFICIENCIES : to promote volume growth or sustainability, promote customer satisfaction and improve market share	
SAFETY: Improved safety levels to Reduce/eradicate the number of injuries and fatalities to staff and other port users.	
REGULATORY/ENVIRONMENTAL COMPLIANCE: Contribution to sustainable green port system	
ENTREPRISE RISK: Impact on business if project is not undertaken	

3.11 Is there any criteria that should be considered and is not included in the list above?

APPENDIX 2

Consolidated Interview Transcript - Round 1 Qualitative Research

INTERVIEW SCHEDULE FOR CAPEX APPROVAL TEAM

	Subject 1	Subject 2
Name of Interviewee	Leon Haridas	Done Manikum
Date of the Interview	21/11/2018	21/11/2018
Place of the Interview	Telephone -Durban	Skype- Durban
Key Challenges with project delivery in South Africa		
In this section, the interviewer aims to identify the current challenges (if any) with project delivery in National Ports Authority		
In your opinion ,does infrastructure development in your organization impact the South African economy?	Yes it will. It is through infrastrucutre development that our economy is stimulated. The construction industry results in job creation which influences the macro-economy and technology sectors. It is only through state-owned companies that a pronounced impact can be seen	No,not as much as it should.TNPA is not seen as a catalyst for economic growth. We should be the heartbeat of the economy but we fall flat as we fail at economic growth and job creation .
What would you list as the principle reasons for non-delivery of infrastructure in your organization	We are ill-equipped with the correct resources as workers display low levels of competency and maturity . Some processes are inefficient and need to be re-visited as they prolong execuuiou of projects. A more agile approach is needed.	Firstly,we need to review our processes which would resolve our bottlenecks. And we need to ensure our resources are adequately skilled .
Is there a problem to secure capital funding for infrastructure development projects?	Yes there is. Although a lot of funding is derived from revenue enhancing operations,the mega projects being put into operation require external funding.	Somewhat. It depends on how TNPA is viewed and the current financial climate as we as investor confidence in our ability to deliver. Ethics impacts our ability to get fundiing as we are seen as corrupt leading to peoples hesitation to extend credit.
Do you believe that your organization are losing investor confidence? If yes, why do think this is happening	Yes.Based historically on the poor CAPEC performances, regulatory bodies lose confidence in the NPA's ability to deliver due to prior poor financial and time management.	Yes. Current news regarding corruption scandals as led to speculation about TNPA's ethics which reflects badly on the whole of Transnet.
Would you say that there is more project failure or project success in terms of the meeting the time, cost, scope and quality objectives of the project?	Definitely more project failures.Project metrics show constant late delivery as well as chronic overspending or underspending	More failures yet I would say it's more of a lack of success. I believe it is due to poor planning and resource constraints which has led to bottlenecks and the lack of skills of those resources. We often deliver projects late,exceed the budgets and have quality defects .
Investment Decision making in State Owned Enterprises		

The aim of this section is to explore investment decision making in state owned companies within South African ports in comparison to other international ports		
What would you cite as the reasons that the Ports Regulator South Africa rejected your organization's first tariff application in 2017?	Poor past performances by CAPEX.	TNPA is not delivering on our mandate. We don't do the things we indicated we would such as delivering services, infrastructure or job creation . We're not stimulating the economy yet we receive benefits without giving back.
Is the port development framework plan aligned to the organization's business strategy?	It should be. The PDFP used is regularly updated to ensure strategic alignment however due to the dynamic environment there is misalignment in short-to-medium term strategies	No. Our business strategy is drastically changing and the PDF plans are not agile or robust enough to keep up with it. We need a thorough review to get some kind of alignment . The business strategy is not currently supporting the infrastructure development.
Are the organization's objectives aligned to the Port Tariff Methodology for investment in infrastructure?		I don't think so.

Project Management best practices in Southern Africa		
In this section, the interviewer intends to identify the contributors to project selection and prioritization by reviewing the port objectives against the port tariff methodology and aligning them to the prioritization of infrastructure in South African ports.		
Is capital being spent on the right projects within your organization?	No.	In Durban it is. In other parts more alignment to the development plans is needed.
What is the current process of selecting projects for the corporate plan in your organization?	The current method is preparedness or lack of preparedness of business cases regardless of the strategic intent . If it has been earmarked the project is either executed or deferred.	As far as I'm aware there's not set process . The team decides what they want to do and then they add it onto the corporate plan.
Do you believe that projects are selected using objective selection criteria	Not really. A criteria is used however it is not always objective or consistent. It needs to be more clinical and standardised .	No.
In your opinion, is the manner of selecting and deferring projects in your organization aligned with best practices of other SOEs in the port environment	No. CAPEX readiness determines if projects are deferred or selected. There is no strategic intent . A framework is needed .	No. We don't look at the business impact or the risks associated with taking more time. Deferring projects could lead to more costs and other repercussions in the future. We need to be more realistic and logical when selecting projects .
What would you regard as best practice in project selection within SOE's such as your organization?	A ranking and selection model is needed. Tool levers should be based on strategic intent, fit and alignment .	The organization needs to understand what their goal is and which projects support their business strategy . They need to know their constraints, with regards to money and resources , and have a valid selection criteria (funnel and gate) . Furthermore, participation from higher management is needed.

Do you believe that your organization follows best practice in project selection?	No.	No.
What does the organization do to facilitate good practice in project selection and what are the threats to this process?	There is evidence of this methodology but the organization has not embraced it fully and we need a change in mindset .	We are not facilitating good practices . EPMO rankings are not being used, funnel gate review is not being used and there is no buy in from top management which makes things more difficult.
What are the barriers to providing objective project selection in your organization?	The legacy of how we used to do things has led to a rigid mindset. We need to depart from this to embrace best practices .	There's no holistic view of the business. People have a silo mentality which leads to poor co-operation and a lack of streamlining .
Can you recommend tools and techniques to improve project selection in developing the corporate plan?	Funnel and gate approach would be recommended. We need to change the legacy of mishandling projects and clean out the corporate plan.	A funnel and gate model for selection needs to be put onto the corporate plan. We need to pin down the process in order for there to be commonality
Rate the following criteria in order of importance in project selection on a scale from 1-8 where 1 is the most important and 8 is the least important criterion in project selection.		
Criteria for project Selection	Rating	Rating
If projects were to be ranked and scaled using uniform criteria in your organisation, how would you rank the following project selection criteria? Rate the criteria below on a scale from 1-10 where 1 is the highest rank and 10 is the lowest rank of prioritization.		
FINANCE AND FUNDING: revenue growth, financial viability (NPV, IRR etc)	4	3
CAPACITY CREATION: Maintain adequate, reliable port Infrastructure and Fleet, Increase infrastructure/ Fleet capacity and/ or support/promote market growth, Promote optimized land use	1	3
QUANTIFIABLE OPERATIONAL EFFIEICIENCIES : to promote volume growth or sustainability, promote customer satisfaction and improve market share	1	2
SAFETY: Improved safety levels to Reduce/eradicate the number if injuries and fatalities to staff and other port users.	1	2
REGULATORY/ENVIRONMENTAL COMPLIANCE: Contribution to sustainable green port system	2	3
ENTREPRISE RISK: Impact on business if project is not undertaken	3	3
Is there any criteria that should be considered and is not included in the list above?	The criteria needs to change(annually for minimal changes and every 2-5 years for drastic changes) based on the contextual horizon of the current political and economic situation	No, the list seems sufficient.

Consolidated Interview Transcript - Round 1 Qualitative Research

INTERVIEW SCHEDULE FOR CAPEX APPROVAL TEAM

	Subject 3	Subject 4
Name of Interviewee	Siyabonga Ndwandwe	Kabelo Modipane
Date of the Interview	21/11/2018	21/11/2018
Place of the Interview	Face to face - Kingsmead	Telephone- Johannesburg
Key Challenges with project delivery in South Africa		
In this section, the interviewer aims to identify the current challenges (if any) with project delivery in National Ports Authority		
In your opinion ,does infrastructure development in your organization impact the South African economy?	Most definitely, especially in the context of Durban. DPE has questioned impact of searching for sourcing of funds for projects leading to delays. Delays in projects have been linked to KZN's low GDP and a lack of job creation . Since a single project can lead to so many delays, multiple projects amplify this effect.	Yes it does due to the logisitic chain. It's a major revenue sector. Also the volume projections of what is handled in the ports require infrastructure with the capacity to handle it.
What would you list as the principle reasons for non-delivery of infrastructure in your organization	Very rarely do we deliver on time and within budget. Poor project selection and a lack of adequate and competent resources effects our delivery. There's a lack of alignment to business strategy and best practice . As we are a state owned enterprise there are plotical influences. We,as a regulated entity, have to account for more than the private sector.	The major factor is an inadequate supply of skilled resources to deliver on projects which contributes to delays. Also, the system that is not intergrated within Transnet.working in silos and a lack of intergrated planning
Is there a problem to secure capital funding for infrastructure development projects?	Yes,most definitely. The state of financial and political stability in the country impacts how we find funding for our projects. When we are forced to find funding from foreign investors our projects are delayed and inevitably end up over budget.	I don't see a problem because most of the projects I've been involved in have secured funding.
Do you believe that your organization are losing investor confidence? If yes, why do think this is happening	Yes, from a projects point of view but not from a balance sheet point of view.This is linked to how our infrastructure projects effect our economy. Non-delivery on fiscal and job creation have lowered investor confidence .	Yes,we are losing investor confidence as we are consistently under delivering on what is expected this is due to failure to plan properly. We are unable to communicate realistic timelines that are possible within our environment as a state owned enterprise
Would you say that there is more project failure or project success in terms of the meeting the time, cost, scope and quality objectives of the project?	More failures as we often exceed the time limits given (however this may be due to inadequate or incompetent resources) and we spend more than the budget allows (this may be because of poor planning). However there is project success on scope as projects do deliver on scope objectives.	There are more failures. In the general project environment,there are few projects that can be classified as a success when being measured against these parameters.In our environment it is the same. Most of our failures are mainly from a lack of proper planning . We have seen many instances were the project takes of smoothly in feasibility and execution but then experiences problems from the thing that should have been taken care of in the pre-feasibility stage as a result we see delays,escalations and so on. Inadequate resources lead to delayed projects. Poor brief selection and pre-feasibility studies cause problems to arise and it's challenging for the teams to develop solutions to those problems.This effects the time taken to deliver on the projects. Also missing details on the scope causes further delays.
Investment Decision making in State Owned Enterprises		

The aim of this section is to explore investment decision making in state owned companies within South African ports in comparison to other international ports		
What would you cite as the reasons that the Ports Regulator South Africa rejected your organization's first tariff application in 2017?	Because tariff applications are based on the premise that we will deliver on the promised infrastructure and historically we have the trend of not delivering. So we receive the money but don't deliver to support what we charge.	I'm not privy to the details.
Is the port development framework plan aligned to the organization's business strategy?	In my limited understanding, I would say yes. I believe the port development framework is the business strategy.	There is alignment but the business strategy needs to be updated to reflect current trends on the port development framework. It was based on the demand and commodities expected to be handled by the port system and also taking into consideration nationwide on which commodities are to be handled where. The ports use it as a guide for future expansion of what is planned to be handled as detected by the demands and trends.
Are the organization's objectives aligned to the Port Tariff Methodology for investment in infrastructure?	That's always the intention at the beginning however more focus is spent on spending the money than on delivering the infrastructure required.	

Project Management best practices in Southern Africa		
In this section, the interviewer intends to identify the contributors to project selection and prioritization by reviewing the port objectives against the port tariff methodology and aligning them to the prioritization of infrastructure in South African ports.		
Is capital being spent on the right projects within your organization?	Yes. A lot of the projects are either to expand or sustain capacity. There is alignment between the projects and the organization.	Yes. Most projects are undertaken for capacity creation and to stimulate the economy of the country so that we don't lose potential customers.
What is the current process of selecting projects for the corporate plan in your organization?	Project selection may not be an issue but readiness and prioritizaion may be an issue. Currently although projects had been selected we were unable to begin as we were not ready and uncertain of which project needed more of our focus.	I'm not aware of any specific process being used on the corporate plan. EPMD has a process to rate projects in the model but the process to input the data and the application of this data is not effective or, in my opinion, used.
Do you believe that projects are selected using objective selection criteria	For the most part. Projects are selected to sustain or improve capacity. However certain projects need a specialized criteria in order for them to be prioritized.	An objective selection criteria is there however the criteria is not being utilised by TNPA.
In your opinion, is the manner of selecting and deferring projects in your organization aligned with best practices of other SOEs in the port environment	Deferral is based on the readiness of the business case and our organization.	I don't think so. Projects are being deferred based on the financial situation in that specific year rather than on the order of priority of selecting those projects. Poor planning also causes projects to be deferred.
What would you regard as best practice in project selection within SOE's such as your organization?	Most projects are revenue generating so we need to look at financial indicators, safety which is non-negotiable and bulk services which would be used to run the port.	Basically looking at the necessity of projects and the comparative benefit model of each project. Also the numerical and non-numerical model. Numerical would be return on investments and non-numerical would be the comparative necessity.

Do you believe that your organization follows best practice in project selection?	I don't believe that.	No,I don't think so.How they are identified supports the strategy but the gaps that were previously stated need to be closed
What does the organization do to facilitate good practice in project selection and what are the threats to this process?	Our planning is poor as we realise things halfway through the projectsand start questioning our decision making although nothing can be done.I would say non-delivery and cost over runs is also a threat.Delaying job creation also negatively impacts our organization.	We are not using best practice to select projects. We need to implement a best practice model to get things done however I don't think there are any threats.
What are the barriers to providing objective project selection in your organization?	Technological advancements that lead to deferred projects becoming obsolete. Political and shareholder influence has an effects on project selection. Personal preferences from higher management could lead to bias in project selction.	People are prioritizing projects they want to be done rather than prioritizing projects that could be beneficial to the organization. Another problem is that there's no analysis of the resources required to execute the projects we need to do which results in delays in the processes the projects need to undertake.
Can you recommend tools and techniques to improve project selection in developing the corporate plan?	So we need to prioritize project financial indicators,safety and bulk services .	We need to look at the profitability index of each project. We could use project scoring models to evaluate the scoring and ranking of each project.
Rate the following criteria in order of importance in project selection on a scale from 1-8 where 1 is the most important and 8 is the least important criterion in project selection.		
Criteria for project Selection	Rating	Rating
If projects were to be ranked and scaled using uniform criteria in your organisation, how would you rank the following project selection criteria? Rate the criteria below on a scale from 1-10 where 1 is the highest rank and 10 is the lowest rank of prioritization.		
FINANCE AND FUNDING: revenue growth, financial viability (NPV, IRR etc)	1	1
CAPACITY CREATION: Maintain adequate, reliable port Infrastructure and Fleet, Increase infrastructure/ Fleet capacity and/ or support/promote market growth, Promote optimized land use	1	1
QUANTIFIABLE OPERATIONAL EFFIEICIENCIES : to promote volume growth or sustainability, promote customer satisfaction and improve market share	1	5
SAFETY: Improved safety levels to Reduce/eradicate the number if injuries and fatalities to staff and other port users.	1	2
REGULATORY/ENVIRONMENTAL COMPLIANCE: Contribution to sustainable green port system	5	4
ENTREPRISE RISK: Impact on business if project is not undertaken	3	5
Is there any criteria that should be considered and is not included in the list above?	No.	No,there's nothing.

Consolidated Interview Transcript - Round 1 Qualitative Research

INTERVIEW SCHEDULE FOR CAPEX APPROVAL TEAM

	Subject 5	Subject 6
Name of Interviewee	Amit Nandukar	Janitha Maharaj
Date of the Interview	21/11/2018	09/01/2019
Place of the Interview	Face to face - Durban	Telephone - Johannesburg
Key Challenges with project delivery in South Africa		
In this section, the interviewer aims to identify the current challenges (if any) with project delivery in National Ports Authority		
In your opinion ,does infrastructure development in your organization impact the South African economy?	Most definitely. We contribute to the GDP and a small percentage to KZN. Whatever we do contributes to the provincial economy and also to moving commodities across the border.	Absolutely. The port and especially the wet assets and services provided as the Ports Authority provide the gateway for the South African economy so without the infrastructure development, our economy is severely impacted as you can see with other landlocked countries that have to rely on countries that have access to ports with strong infrastructure development that can facilitate their trade
What would you list as the principle reasons for non-delivery of infrastructure in your organization	Historically,Transnet built a lot of infrastructure that did not have a large return on investments. Since then we have adopted the PLP process that outlines the project's plan from conception to full execution showing the feasibility of the project. So although the project takes a long time it will,theoretically,contribute the most revenue and alleviate poverty . As a government organization we are audited quite often and have to follow PFMA,we must show that we are contributing to the fruits of the nation and churn our economy . We do take a long time but that is because we follow a arduous process.to ensure we deliver on our investments.The Transnet approval process takes a long time,in terms of governance process.	Transnet as a whole is a very projectised environment looking at the nature of projects that they run, the strategic initiatives that they want to develop but strangely enough we do not employ the right methodologies and skills set in actually delivering these projects. Even on the maintenance side, the assets we have are aged to the point of deterioration and then you have to inject capital funding into it. The mindset of the organisation needs to change, we need to become more serious about project delivery and in doing that we need to ensure that we have the right processes in place to ensure and facilitate good project delivery. We also need to have a projectized mindset in terms of taking projects seriously that will not just benefit the organisation but the economy as a whole. One of the principal reasons is the changing strategies within SOEs. We give ourselves 5 yrs to realise a strategy and when that doesn't work, we move onto the next one without really understanding why the initial strategy didn't work.
Is there a problem to secure capital funding for infrastructure development projects?	No there's no problem. We follow a rigid prioritization process therefore money can only be spent where we can get some form of return. Priority is given to meeting our MDS and 4.0 targets meaning we need to be spending our money where we are adding capacity into the system therefore projects that we want to do for some social benefit will be deferred .	yes. As the landlord authority that still resides within Transnet, it is a problem to secure capital funding because the capital funding is weighed against other operating divisions as well by way of cross subsidization. So there is a pool of money that needs to be spread across all ODs and TNPA is not treated as a separate entity with Transnet.
Do you believe that your organization are losing investor confidence? If yes, why do think this is happening	I don't think we're losing investor confidence but there will always be public sentiment to say different however the port system is fundamental to growing our economy (yet you could argue we have the monopoly and can hence speak that way). We achieve our targets and therefore can benchmark ourselves as worldclass and if the confidence was not there, we would not have received funding for our current berth deepening project.	Although Transnet's financial performance has been good, governance issues especially around the tenders etc is dampening investor confidence . The lack of thinking outside the box as well. If you want to be worldclass you have to think differently. Investors are also losing confidence because we haven't proven to be beyond reproach when it comes to governance . It seems that Transnet has been in a negative light with state capture and the principles that have been implicated thereof. So these impact on shareholder confidence and investor confidence in terms of securing capital but also getting right resources and good skills. Who wants to be associated with a company that is tainted. You are not going to attract world class people that would actually want to work in the organisation. It has a double edged sword.
Would you say that there is more project failure or project success in terms of the meeting the time, cost, scope and quality objectives of the project?	In some aspects the projects are successful as they deliver on it's quality objectives but in other aspects there can be failure in terms of being over budget and exceeding time restraints because of the obligations we have as a state owned enterprise. However we do deliver on the mandate of the business case.	there's a 50/50 almost. We have had projects with success in line with the question but when you unpack this a little bit more and look at benefits , then we are not achieving project successes because our PIR rating that we are not meeting the objectives that the intended project set out to achieve. So it's a little bit more skewed to project failure as opposed to project success.
Investment Decision making in State Owned Enterprises		

The aim of this section is to explore investment decision making in state owned companies within South African ports in comparison to other international ports		
What would you cite as the reasons that the Ports Regulator South Africa rejected your organization's first tariff application in 2017?	We have an asset base of about 25 billion wick may seem like a lot however that is spread over a large area but because of our rigorous processes we are not spending the committed funds on infrastructure each financial year.	Our tarriff methodology is more in line with not creating new assets or creating new business but rather on sustaining what we already have which is your existing infrastructure assets which in terms of the years have been paid off. Hence we are not really creating new assets for new business. The other reason is that TNPA's profits are diluted within the bigger scheme of Transnet and the cross subsidization of funding is probaly one of the reasons why the regulator has rejected the tarriff application
Is the port development framework plan aligned to the organization's business strategy?	Most definitely.the port development framework plan aligns to the 4.0 , the corporate plan and obviously we follow the long-term framewok plan but fundamentally we need to ensure the future demand growth for commodities crossing the key wall is realized ahead of time.	im going to be controversial and say not entirely because the PDFP is somewhat isolated when you look at the new business, the future, growth aspects, opportunities for renewing our leases and licences etc which is one of our oversight roles as the ports authority. That really doesnt feed into the PDFP.
Are the organization's objectives aligned to the Port Tariff Methodology for investment in infrastructure?	There is no misalignment because in terms of our new strategy we are heavily aligned to ensure we meet our customer needs,we have our top standards ,skilled resources in the port, our staff and source other skills when needed.	Up until recently no, it has not been aligned . It was taken as business as usual and we can increase our tarriffs without increasing our business offering in the most recent tariff engagement with the regulator its become obvious that they are not going to give us the increases that we ask for and they have cited strong reasons for that. We need to think of new ways on how we put our tariff application through where we show actually growth on our revenue streams and service offerings and not on being over reliant on year on year cargo dues through tarriff increases.

Project Management best practices in Southern Africa <i>In this section, the interviewer intends to identify the contributors to project selection and prioritization by reviewing the port objectives against the port tariff methodology and aligning them to the prioritization of infrastructure in South African ports.</i>		
Is capital being spent on the right projects within your organization?	According to the prioritization metrics (EPMO) certain guidelines receive more weighting and I disagree with this. Hence we are measuring something with an 'incorrect measuring tape' . Some projects do not require as strict a weighting process as they endure. The definition and categorization of projects may skew the priority of the project.	No, the bulk of capital projects is more on refurbishment and capitalised maintenance because we have not been serious about doing our maintenance properly. We are not spending the capital that we should be investing to create new assets for growth, stimulation of the economy etc. TNPAs investment plan is very top heavy on maintenance projects, a 60/ 40 split between maintenance and new business investment. Fixing this means that we need to look at projects that will drive Transnet's objectives to new business growth and facilitating that growth in the economy and <i>obviously changing our approach to maintenance</i>
What is the current process of selecting projects for the corporate plan in your organization?	The EMPO model is used at the moment. Each project is evaluated using this model and then assigned a number and placed on a list. Revenue is then distributed accordingly .	the current process is very haphazard. We are not aligning ourselves to best practice in terms of what's happening in the international space. Each port develops an investment plan or corporate plan for their port and that gets rolled up into TNPA's corporate plan. Although there is a ranking model of sorts, that ranking model is not robust enough to decide if these are the projects to help us develop our economy or facilitate trade within our country. Each port should have an investment plan talking to the growth initiatives in that particular sector and understand what projects need to be undertaken to facilitate that growth and improvement within that sector. Its currently <i>not happening in that manner</i>
Do you believe that projects are selected using objective selection criteria	The criteria is objective however I do have reservations about the weighting of this criteria.	No. There is no robust ranking model that talks to our strategy and our objectives as Transnet or even if we were unregulated that talks to the countries roles, strategy and initiatives.
In your opinion, is the manner of selecting and deferring projects in your organization aligned with best practices of other SOEs in the port environment	We do have an objective tool we use to select and defer projects however once it gets to CAPIT the tool is not used and we are guided by the principles of CAPIT in prioritizing our projects.	No. The current manner in which we select or defer projects is largely based on funding . Whether you have the funds or not. Internally we are held to ransom in that we have to ensure that projects that have already been contracted remain viable and funding needs to be set aside for those projects. Whether those projects are actually going to realise the business need is not looked at. Because these projects are contracted, we are unable to pull the plug on these projects so we need to go ahead with projects simply because they are contracted. we don't look at other criteria, we dont look at other practices that could be implemented to ensure that we defer projects or we select projects in the right manner. Currently projects are being deferred if they do not have business cases ready in time for funding allocation This is a lazy approach because you could be deferring projects that would benefit the organisation strategy but purely because of our lack of readiness and preparedness, we lose opportunities.
What would you regard as best practice in project selection within SOE's such as your organization?	A prioritization tool should be used. The selection of our projects needs to align with the NDP and other governmental policies but also with our core values as an organization.	you need to understand what your strategy and objectives are. What do you want to achieve. This cannot be changing every 2 years or 5 years, you must have a trajectory for the short to medium term and medium to long term. Once you define that strategy, you start looking at what are gaps and opportunities in your business are what are those things that you need to do differently to achieve that strategy. once you identify that then you start going through your selection of identifying key projects that will now deliver on that strategy. Currently in our organistaion, we have strategies that change every 3 to 5 years depending on who the group CE is. We did not deliver of the previous MDS strategy but nobody wants to answer the question of why we didnt deliver on MDS. Were we too optimistic, were we lazy in our approach to roll up our sleeves and answer some difficult questions. We didnt fully analyse that before we jumped to the new strategy which is 4.0. So we make these mistakes continuously because our strategies keep on changing but we know when it comes to project delivery, a simple project could take up to 3 to 4 years to actually realise benefits . By the time you've delivered on the project, the strategy has changed. Non delivery of capital is not an infrastructure problem, it is a business problem. if non delivery of infrastrucutre is no.1 on the strategic risk register for TNPA then there must be more focus at a holistic business level.

Do you believe that your organization follows best practice in project selection?	I'm not convinced that weightings in the prioritization tool are correct.	No. sufficient reasons have been given.
What does the organization do to facilitate good practice in project selection and what are the threats to this process?	We need to re-evaluate the selection process we are using to take into account current variables including the economic climate of our country. This may ensure we deal with our risk mitigation in a more cost effective manner.	There are pockets of good processes but it is a matter of pulling all these things together and looking at it objectively to say that if this is the foundation what we are setting and if this foundation is robust enough then project selection becomes easier to facilitate but if we remain with this fragmented approach and pockets sitting everywhere else. we are not going to get it right
What are the barriers to providing objective project selection in your organization?	The project team at the inception of the project is not defined therefore when the project prioritization tool is being used it's only the project manager at the time who has input. The project team and the sponsor are not doing that. Selection becomes subjective due to this singular input rather than collective.	Skills and competence , the changing strategy. Up until you have a medium term view of where you are going and where you want to be, you are going to have a huge problem in selecting that strategy. There's also some bias where projects are undertaken as pet projects that could be linked to political appointments or other agendas. Are we spending funding in the right projects that is independent of other agendas be it political agendas, self enrichment aspirations etc.
Can you recommend tools and techniques to improve project selection in developing the corporate plan?	The ten year corporate plan is just being updated each year, it's not being revised and re-evaluated. The port development framework plan needs to show the broadcasted demands over the next 30 years. Currently there is misalignment between the corporate plan and the port development framework plan and that needs to change	a robust ranking model with good criteria for project selection , the firmed up organisational strategy of where you want to be, using good methodologies. We have somehow standardised our methodologies but to implement those methodologies you need the right skills and tools . The organisation currently takes the view that anyone can be a project manager and this is very frightening. We see how these poor souls are thrown into the deep end and don't even have a basic idea of project management. So these are some of things we need to get right and outprocesses aligned to project delivery as well. The PPM, the internal processes and policies that we have must be aligned to foster and ensure that we improve project selection and help us in the right direction. also the PDFP plays a big role as i mentioned earlier understand the business need of the port within its environment and how it serves the hinterland and surrounding communities so we know that we are doing projects to enhance that hinterland and develop the community as well.
Rate the following criteria in order of importance in project selection on a scale from 1-8 where 1 is the most important and 8 is the least important criterion in project selection.		
Criteria for project Selection	Rating	
If projects were to be ranked and scaled using uniform criteria in your organisation, how would you rank the following project selection criteria? Rate the criteria below on a scale from 1-10 where 1 is the highest rank and 10 is the lowest rank of prioritization.		
FINANCE AND FUNDING: revenue growth, financial viability (NPV, IRR etc)	1	1
CAPACITY CREATION: Maintain adequate, reliable port Infrastructure and Fleet, Increase infrastructure/ Fleet capacity and/ or support/promote market growth, Promote optimized land use	1	2
QUANTIFIABLE OPERATIONAL EFFICIENCIES : to promote volume growth or sustainability, promote customer satisfaction and improve market share	5	2
SAFETY: Improved safety levels to Reduce/eradicate the number of injuries and fatalities to staff and other port users.	1	1
REGULATORY/ENVIRONMENTAL COMPLIANCE: Contribution to sustainable green port system	1	1
ENTREPRENEUR RISK: Impact on business if project is not undertaken	1	2
Is there any criteria that should be considered and is not included in the list above?	There should be sub-criteria for safety which should include whether there will be loss of life, damage to fleet or environmental concerns. Up-skilling our existing resources to reduce staff turnover should also be considered	strategy alignment ; technical solution development and value improvement practices

APPENDIX 3

Dear Respondent

I, Renee Naidoo, am studying towards a doctoral degree at the Graduate School of Business Leadership: University of Kwazulu Natal.

Researcher: Ms Renee Naidoo Contact: 031 361 8121
Supervisor: Dr Muhammed Hoque Contact: 031 260 8690
Research Office: Mariette Snyman Contact: 031 260 8350

You are invited to participate in a research project titled "**Developing a Project Selection Model to Support Infrastructure Investment Programs within the Ports Authority, South Africa**" The aim of this study is to improve TNPA's competitive positioning by improving the quality of capital investment decisions.

This research has been conducted using a mixed methods approach. In round 1 of the research, interviews were conducted to identify the gaps in project delivery within TNPA. Using the results of the qualitative study, a project prioritization model was developed and implemented. Through your participation, I will establish the effectiveness of the model to select, rank and prioritise projects for alignment with the business goals.

Your participation in this research is voluntary. You may elect not to participate or to withdraw from the research at any time with no negative consequences. There will be no financial gain from participating in the research. All responses will be treated with the strictest confidentiality. The Graduate School of Business Leadership: UKZN will ensure anonymity of all records contributing to the research.

If you have any questions or concerns about completing the questionnaire or about participating in this research, you may contact me or my research supervisor – see contact details above.

This survey can be completed in 5 minutes. I would appreciate you taking the time to contribute meaningful to the study.

Kind Regards

Researcher's Signature
Name: Renee Naidoo
Contact no.: 063 407 3806
Email: renee.naidoo@transnet.net

Date

APPENDIX 4

QUESTIONNAIRE

Section 1 -Demographic Information

For the purpose of statistical analysis of responses received, kindly provide the following demographic information

		Project Management	Project Controls	Engineering	Strategy and Planning	Other (please specify)
1	Please indicate your job category					

		0-6	7-12	13-18	19-24	25 +
2	Indicate your number of years of experience in this role					

		Eastern	Central	Western	2 or more	None
3	Region of Influence within TNPA's Project Management Office					

Section 2 - Key contributors to Project Selection and Prioritisation

Please indicate your level of agreement with the statements below

		Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
		1	2	3	4	5
1	The prioritization model is simple and easy to use					
2	The model allows objective screening in selecting and prioritizing projects					
3	There is increased stakeholder involvement in project selection by screening port requirements before projects are listed on the corporate plan					
4	Through implementation of the model, projects are selected, prioritised and ranked through an objective, uniform process					
5	A project selection committee is used in selection and ranking to remove bias in the process					
6	The principles of project selection and prioritization are applied uniformly irrespective of the size of the project					
7	The Capital portfolio selected will assist TNPA in the following:					
i	Boost TNPA revenue to ensure sustainability;					
ii	Assist with job creation in order to stimulate the economy;					
iii	Assist ports in becoming more efficient in its operations and services;					
iv	Assist TNPA to become more responsive and agile in understanding and fulfilling customer needs;					
v	Ensure that port infrastructure is reliable and compliant.					

Section 3 - Strategic Alignment - The model guides project selection to align with Transnet's strategic objectives

Please indicate your level of agreement with the statements below after implementation of the Prioritization model

		Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
		1	2	3	4	5
1	TNPA's investment spending is aligned to its strategic initiatives to support the MDS and volume growth					
2	The model requires project objectives to be clearly defined by the Sponsor					
3	Prioritising projects is likely to improve project delivery by focusing efforts of the business on the 'RIGHT' things					
4	Improved project delivery will improve investor confidence in TNPA (EG Ports Regulator, customers etc)					
5	Are you in agreement with the project selection criteria listed below?	Yes (use)	No (remove)			
i	FINANCE AND FUNDING: revenue growth, financial viability (NPV, IRR etc)					
ii	CAPACITY CREATION: Maintain adequate, reliable port Infrastructure and Fleet. Increase infrastructure/ Fleet capacity and/ or support/promote market growth Promote optimized land use					
iii	QUANTIFIABLE OPERATIONAL EFFICIENCIES : to promote volume growth or sustainability, promote customer satisfaction and improve market share					
iv	SAFETY: Improved safety levels to Reduce/eradicate the number if injuries and fatalities to staff and other port					
v	REGULATORY/ENVIRONMENTAL COMPLIANCE: Contribution to sustainable green port system					
vi	ENTREPRISE RISK: Impact on business if project is not undertaken					
vii	JOB CREATION/ SKILLS DEVELOPMENT: direct project contribution to skills and jobs					
viii	OVERALL ALIGNMENT TO BUSINESS GOALS: strategic fit					

Section 4 -Project Selection and Ranking improved investment decisions

Please indicate your level of agreement with the statements below before & after implementation of the Prioritization model

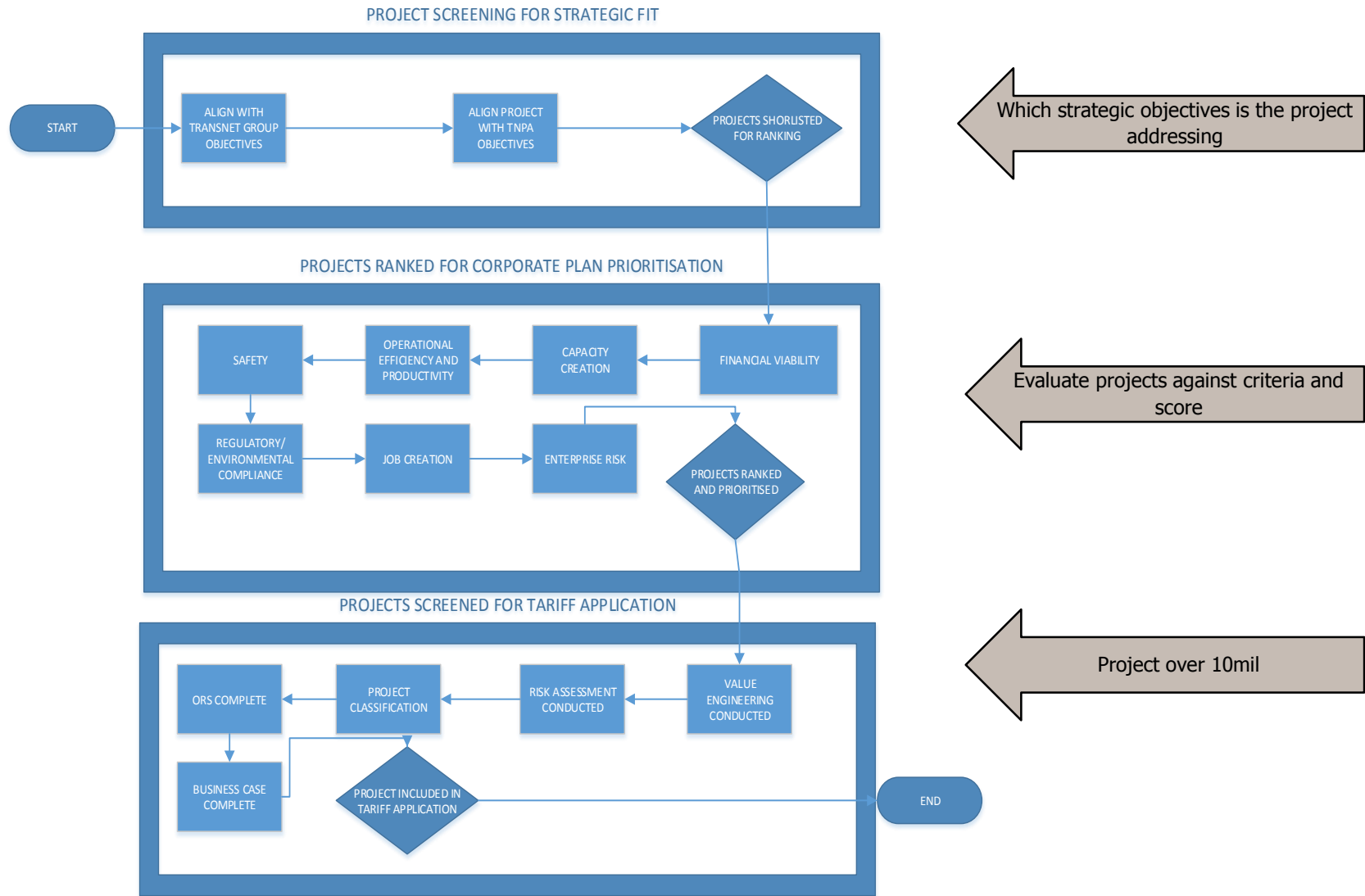
		Before Model		After Model	
		Agree	Disagree	Agree	Disagree
1	Projects are scaled and ranked using uniform criteria				
2	Projects are ranked and scaled in the corporate plan according to their interdependencies				
3	Projects in execution phase take priority for funding considerations				
4	Investment decisions are biased				
5	There is misalignment between the project team and the business it serves				
6	Standard project management methodology is used effectively on projects				
7	The project approval and prioritisation processes are aligned to the port development framework plan				
8	The project governance and quality management processes are well defined and procedurally managed				
9	The PMO processes are supported by TNPA leadership				
10	The project reporting process is transparent and consistent				
11	The business benefits of the project is well defined, measured and monitored				
12	Project delivery is measured against key performance indicators predefined with stakeholders				
13	<i>Please indicate (with a v) the project processes that are not procedurally efficient and well defined</i>				
i	project approval and prioritization				
ii	project performance reporting				
iii	project stage gate approval process				
iv	change request management process				
v	risk, issue and dependency management process				
vi	communication management process				
vii	business case development				
viii	project resource management process				

General Comments:

Thank you for completing the questionnaire. You can be assured that all information received will be treated as strictly confidential and will be used for research purposes only.

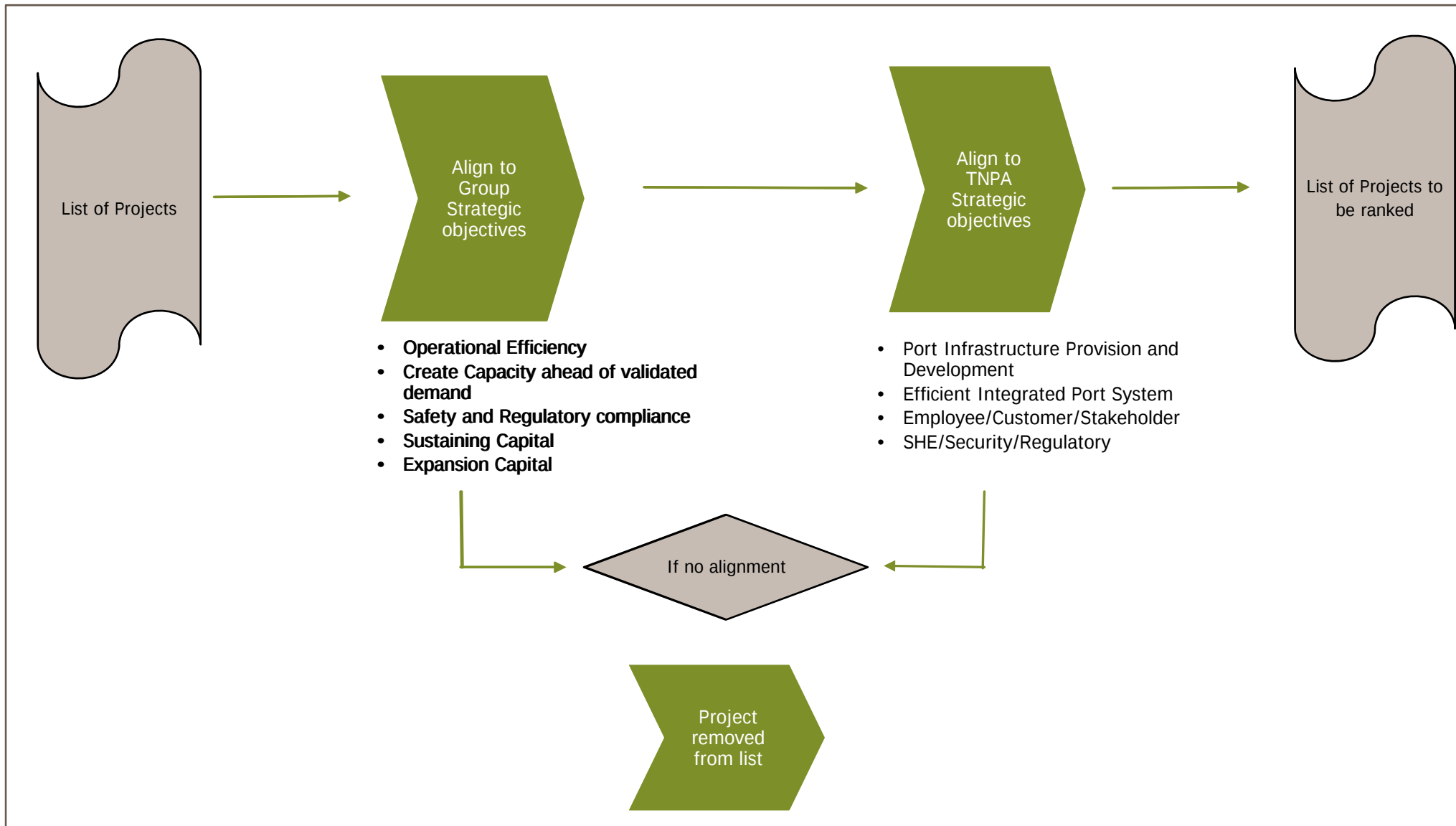
APPENDIX 5

PROCESS FLOW FOR PROJECT SCREENING & PRIORITIZATION



APPENDIX 6 TO 9

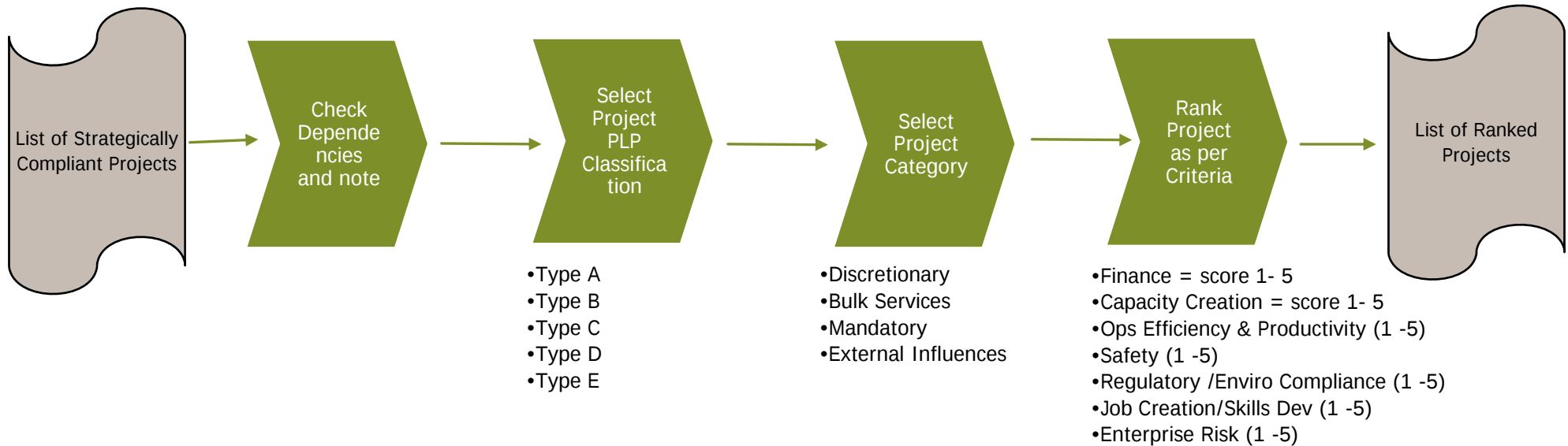
PROCESS FLOW FOR STRATEGIC FIT



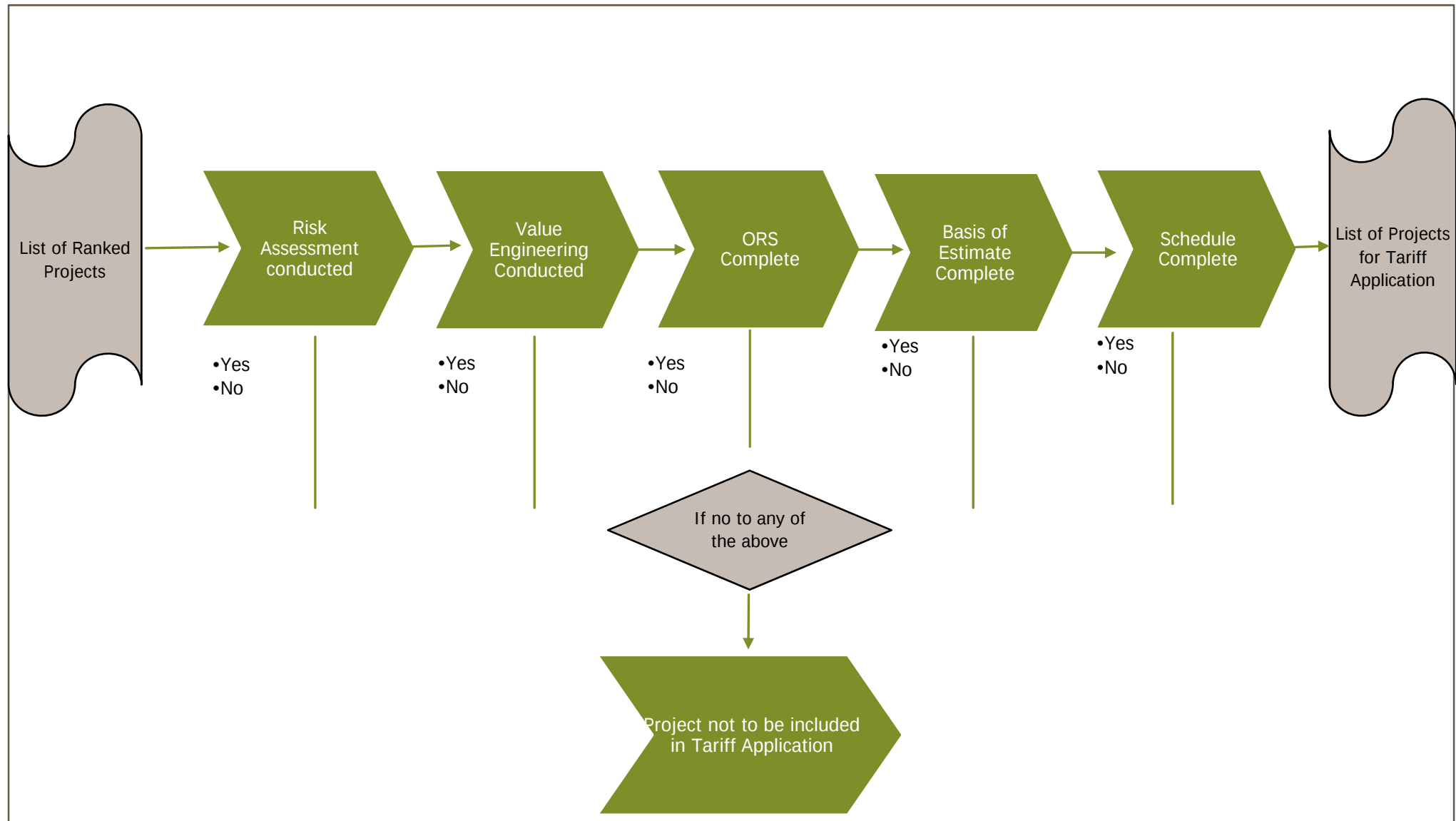
CRITERIA FOR RANKING PROJECTS

Finance	Capacity Creation	Operational Efficiency	Safety	Regulatory/ Environmental Compliance	Job Creation /Skills Development	Enterprise Risk
•Positive NPV; Internal Rate of Return (IRR); •Payback periods; •Profitability Index (PI); •Potential Cost Saving; •Revenue Growth; •New Business Opportunity; •Demonstrate accuracy of estimates; •Demonstrate that cashflows are linked to integrated project plans; •Benefits to be derived.	•Invest capital to support Capacity creation •Invest in infrastructure that will be able to meet the demands of our growing economy.	•Reduce the cost of doing business by streamlining processes. •Improve operational KPIs (berth occupancy, shipping delays or average ship turnaround time).	•Demonstrate contribution to improved safety within the work and TNPA environment.	•Demonstrate contribution to energy efficiency and energy security; •Demonstrate contribution to secure Port System; •Demonstrate contribution to Safe and Sustainable green ports.	•Demonstrate contribution to job creation – Direct and Indirect (FEL 3 and 4). •Demonstrate contribution to skills development (FER to FEL2).	•Demonstrate the risk to the business if project is not undertaken.
20%	20%	20%	15%	10%	10%	5%

PROCESS FLOW FOR PROJECT RANKING



REGULATOR TARIFF APPLICATION



APPENDIX 10

		Correlations															
		The prioritization model is simple and easy to use	The model allows objective screening in selecting and prioritizing projects	There is increased stakeholder involvement in project selection by screening port requirements before projects are listed on the corporate plan	Through implementation of the model, projects are selected, prioritised and ranked through an objective, uniform process	A project selection committee is used in selection and ranking to remove bias in the process	The principles of project selection and prioritization are applied uniformly irrespective of the size of the project	Boost TNPA revenue to ensure sustainability;	Assist with job creation in order to stimulate the economy;	Assist ports in becoming more efficient in its operations and services;	Assist TNPA to become more responsive and agile in understanding and fulfilling customer needs;	Ensure that port infrastructure is reliable and compliant.	TNPA's investment spending is aligned to its strategic initiatives to support the MDS and volume growth	The model requires project objectives to be clearly defined by the Sponsor	Prioritising projects is likely to improve project delivery by focusing efforts of the business on the 'RIGHT' things	Improved project delivery will improve investor confidence in TNPA (EG Ports Regulator, customers etc)	
Spearman's	The prioritization model is simple and easy to use	Correlation Coefficient	1.000														
		Sig. (2-tailed)															
		N	59														
	The model allows objective screening in selecting and prioritizing projects	Correlation Coefficient	.773**	1.000													
		Sig. (2-tailed)	0.000														
		N	59	59													
	There is increased stakeholder involvement in project selection by screening port requirements before projects are listed on the corporate plan	Correlation Coefficient	.529**	.485**	1.000												
		Sig. (2-tailed)	0.000	0.000													
		N	59	59	59												
	Through implementation of the model, projects are selected, prioritised and ranked through an objective, uniform process	Correlation Coefficient	.470**	.554**	.429**	1.000											
		Sig. (2-tailed)	0.000	0.000	0.001												
		N	59	59	59	59											
	A project selection committee is used in selection and ranking to remove bias in the process	Correlation Coefficient	.528**	.578**	.470**	.618**	1.000										
		Sig. (2-tailed)	0.000	0.000	0.000	0.000											
		N	58	58	58	58	58										
	The principles of project selection and prioritization are applied uniformly irrespective of the size of the project	Correlation Coefficient	.545**	.479**	.496**	.486**	.435**	1.000									
		Sig. (2-tailed)	0.000	0.000	0.000	0.000	0.001										
		N	59	59	59	59	58	59									
	Boost TNPA revenue to ensure sustainability;	Correlation Coefficient	.417**	.398**	.268*	.474**	.511**	.439**	1.000								
		Sig. (2-tailed)	0.001	0.002	0.044	0.000	0.000	0.001									
		N	57	57	57	57	56	57	57								
	Assist with job creation in order to stimulate the economy;	Correlation Coefficient	.465**	.372**	.392**	.311*	.500**	.388**	.641**	1.000							
		Sig. (2-tailed)	0.000	0.004	0.002	0.017	0.000	0.003	0.000								
		N	58	58	58	58	57	58	57	58							
	Assist ports in becoming more efficient in its operations and services;	Correlation Coefficient	.580**	.404**	.380**	.367**	.402**	.463**	.554**	.538**	1.000						
		Sig. (2-tailed)	0.000	0.002	0.003	0.005	0.002	0.000	0.000	0.000							
		N	58	58	58	58	57	58	57	58	58						
	Assist TNPA to become more responsive and agile in understanding and fulfilling customer needs;	Correlation Coefficient	.554**	.417**	.456**	.661**	.502**	.543**	.656**	.461**	.690**	1.000					
		Sig. (2-tailed)	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000						
		N	58	58	58	58	57	58	57	58	58	58					
	Ensure that port infrastructure is reliable and compliant.	Correlation Coefficient	.476**	.365**	.403**	.340**	.362**	.540**	.534**	.600**	.748**	.633**	1.000				
		Sig. (2-tailed)	0.000	0.005	0.002	0.009	0.006	0.000	0.000	0.000	0.000	0.000					
		N	58	58	58	58	57	58	57	58	58	58	58				
	TNPA's investment spending is aligned to its strategic initiatives to support the MDS and volume growth	Correlation Coefficient	-0.026	0.083	0.179	0.165	0.102	-0.095	0.101	0.009	0.083	0.100	-0.008	1.000			
		Sig. (2-tailed)	0.847	0.530	0.176	0.212	0.445	0.475	0.455	0.946	0.534	0.454	0.955				
		N	59	59	59	59	58	59	57	58	58	58	58	59			
	The model requires project objectives to be clearly defined by the Sponsor	Correlation Coefficient	-0.081	-0.208	0.115	0.025	-0.076	-0.135	0.021	0.103	0.086	-0.006	0.013	.391**	1.000		
		Sig. (2-tailed)	0.541	0.114	0.387	0.852	0.573	0.308	0.876	0.443	0.522	0.963	0.924	0.002			
		N	59	59	59	59	58	59	57	58	58	58	58	59	59		
	Prioritising projects is likely to improve project delivery by focusing efforts of the business on the 'RIGHT' things	Correlation Coefficient	0.062	0.041	0.072	.275*	0.138	0.154	0.190	-0.009	.378**	.277*	0.216	.593**	.545**	1.000	
		Sig. (2-tailed)	0.642	0.757	0.587	0.035	0.301	0.244	0.156	0.949	0.003	0.035	0.104	0.000	0.000		
		N	59	59	59	59	58	59	57	58	58	58	58	59	59	59	
	Improved project delivery will improve investor confidence in TNPA (EG Ports Regulator, customers etc)	Correlation Coefficient	0.062	-0.092	0.234	0.039	-0.148	0.075	-0.127	-0.026	0.233	0.067	0.153	.398**	.593**	.653**	1.000
		Sig. (2-tailed)	0.641	0.489	0.074	0.771	0.268	0.573	0.345	0.846	0.078	0.617	0.252	0.002	0.000	0.000	
		N	59	59	59	59	58	59	57	58	58	58	58	59	59	59	59

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

APPENDIX 11

		Chi-Square	df	Asymp. Sig.
S1.1	Please indicate your job category	13.552	4	0.009
S1.2	Indicate your number of years of experience in this role	21.61	3	0.000
S1.3	Region of Influence within TNPA's Project Management Office	96.828	4	0.000
S2.1	The prioritization model is simple and easy to use	59.983	3	0.000
S2.2	The model allows objective screening in selecting and prioritizing projects	54.017	3	0.000
S2.3	There is increased stakeholder involvement in project selection by screening port requirements before projects are listed on the corporate plan	65.661	4	0.000
S2.4	Through implementation of the model, projects are selected, prioritised and ranked through an objective, uniform process	22.288	3	0.000
S2.5	A project selection committee is used in selection and ranking to remove bias in the process	37.517	4	0.000
S2.6	The principles of project selection and prioritization are applied uniformly irrespective of the size of the project	47.508	3	0.000
S2.7.1	Boost TNPA revenue to ensure sustainability;	55.912	3	0.000
S2.7.2	Assist with job creation in order to stimulate the economy;	42.828	3	0.000
S2.7.3	Assist ports in becoming more efficient in its operations and services;	59.759	4	0.000
S2.7.4	Assist TNPA to become more responsive and agile in understanding and fulfilling customer needs;	34.276	3	0.000
S2.7.5	Ensure that port infrastructure is reliable and compliant.	51.517	3	0.000
S3.1	TNPA's investment spending is aligned to its strategic initiatives to support the MDS and volume growth	27.017	4	0.000
S3.2	The model requires project objectives to be clearly defined by the Sponsor	54.475	4	0.000
S3.3	Prioritising projects is likely to improve project delivery by focusing efforts of the business on the 'RIGHT' things	56	4	0.000
S3.4	Improved project delivery will improve investor confidence in TNPA (EG Ports Regulator, customers etc)	54.136	4	0.000
S3.5.2	CAPACITY CREATION: Maintain adequate, reliable port Infrastructure and Fleet. Increase infrastructure/ Fleet capacity and/ or support/promote market growth, Promote optimized land use	53.07	1	0.000
S3.5.3	QUANTIFIABLE OPERATIONAL EFFICIENCIES : to promote volume growth or sustainability, promote customer satisfaction and improve market share	53.07	1	0.000
S3.5.6	ENTREPRISE RISK: Impact on business if project is not undertaken	45.632	1	0.000
S3.5.7	JOB CREATION/ SKILLS DEVELOPMENT: direct project contribution to skills and jobs	49.281	1	0.000
S3.5.8	OVERALL ALIGNMENT TO BUSINESS GOALS: strategic fit	53.07	1	0.000
S4.1_before	S4.1_before	10.522	1	0.001
S4.1_after	S4.1_after	37.231	1	0.000
S4.2_before	S4.2_before	8.696	1	0.003
S4.2_after	S4.2_after	32.961	1	0.000
S4.3_before	S4.3_before	0.364	1	0.546
S4.3_after	S4.3_after	38.72	1	0.000
S4.4_before	S4.4_before	2.083	1	0.149
S4.4_after	S4.4_after	5.898	1	0.015
S4.5_before	S4.5_before	0.348	1	0.555
S4.5_after	S4.5_after	12.755	1	0.000
S4.6_before	S4.6_before	2.574	1	0.109
S4.6_after	S4.6_after	24.02	1	0.000

S4.7_before	S4.7_before	0.51	1	0.475
S4.7_after	S4.7_after	27.939	1	0.000
S4.8_before	S4.8_before	4.412	1	0.036
S4.8_after	S4.8_after	20.447	1	0.000
S4.9_before	S4.9_before	1	1	0.317
S4.9_after	S4.9_after	28.88	1	0.000
S4.10_before	S4.10_before	3.314	1	0.069
S4.10_after	S4.10_after	16.333	1	0.000
S4.11_before	S4.11_before	3.314	1	0.069
S4.11_after	S4.11_after	16.333	1	0.000
S4.12_before	S4.12_before	5.12	1	0.024
S4.12_after	S4.12_after	19.612	1	0.000
Q13.1	project approval and prioritization	16.288	1	0.000
Q13.2	project performance reporting	0.831	1	0.362
Q13.3	project stage gate approval process	0.831	1	0.362
Q13.4	change request management process	3.814	1	0.051
Q13.5	risk, issue and dependency management process	12.356	1	0.000
Q13.6	communication management process	1.373	1	0.241
Q13.7	business case development	8.966	1	0.003
Q13.8	project resource management process	12.356	1	0.000

APPENDIX 12

Project Charter

Project Name:

Reduce delay start for CAPIT approvals

Department (s):

Infrastructure

Project Timeline

Start Date:

11 May 2018

Completion Date:

30 April 2019

Chart Revision Date:

Rev 1

Business Case

CAPEX underspend is the shortfall between the planned and actual capital budgets for infrastructure projects. Delay in spending funds budgeted for capital infrastructure projects results in loss of investor confidence and loss in customer base as the infrastructure is not available when required. Reducing delay start for capital infrastructure project approval at TNPA CAPIT will benefit the port in delivering infrastructure on time and within budget.

Problem Statement

Data collected in Port of Durban (POD) from October 2017 to March 2018 indicates that the delay start of FEL 3 project approval at CAPIT is on average 26 months.

Goal Statement

Reduce the turnaround time for FEL 3 capital infrastructure project approval at TNPA CAPIT from 26 months to 12 months by October 2018.

Project Scope

In scope - projects listed on the corporate plan in the 18/19 financial year for the Port of Durban only.
Out of scope - projects in any other TNPA ports for all other financial years.

Project Plan

Start	End	Phase	Task	Sequencing	Resources
11-May-18	11-May-18	Define	Translate VOC to CTQs	1	Team

Expected Benefits

Hard Benefits

Description	Baseline Amount	Projected Amount	Comments / Reasons
none			

Soft Benefits

Description	Baseline Amount	Actual Amount	Comments / Reasons
Improve infrastructure delivery at TNPA Port of Durban	Actual as per corporate plan	Planned as per corporate plan	
Improve Investor confidence	low	high	

Project Metrics	Description	Baseline Metric	Projected Metric
Primary Metrics	Reduce the turnaround time for FEL 3 capital infrastructure project	26 MONTHS	12 MONTHS
Secondary Metrics	Number of capital projects completed on time.	40% on time completion of projects.	50% on time completion of capital projects
Consequential	No additional capital funds	As per signed off fund plan	As per signed off fund plan

Project Resources

Proposed Team	
Name	Role
Renee Naidoo	Green Belt
Siyabonga Ndwandwe	Project Controls Manager

11-May-18	11-May-18		Develop project charter	2	Renee Naidoo
11-May-18	30-May-18	Measure	Map The Process	3	Team
14-May-18	30-May-18		Identify Inputs	4	Renee Naidoo
14-May-18	30-May-18		Collect Data	5	Renee Naidoo
01-Jun-18	01-Aug	Analyse	Plan for Analyse	6	Renee Naidoo
01-Jun-18	01-Aug-18		Analyse the Process	7	Renee
15-Aug-18	31-Mar-19	Improve	Generate & Select	8	Team
15-Aug-18	31-Mar-19		Assess the Risk	9	Team
01-Sep-18	30-Apr-19	Control	Implement the Control	10	Team
01-Sep-18	30-Apr-19		Handover to Process Owner	11	Team

Trinesh Govender	Project Manager
Cliff Pakathi	Project Planner
Gandhi Marule	Black belt
Hamilton Nxumalo	Process Owner
Nokuzola Nkowane	Process Sponsor

APPENDIX 13

08 November 2018

Mrs Renee Naidoo (9502008)
Graduate School of Business & Leadership
Westville Campus

Dear Mrs Naidoo,

Protocol reference number: HSS/1682/018D

Project title: Developing a Project Selection Model to support Infrastructure Investment Programs within the Ports Authority, South Africa

Approval Notification – Expedited Application

In response to your application received 19 September 2018, the Humanities & Social Sciences Research Ethics Committee has considered the abovementioned application and the protocol has been granted **FULL APPROVAL**.

Any alteration/s to the approved research protocol i.e. Questionnaire/Interview Schedule, Informed Consent Form, Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through the amendment /modification prior to its implementation. In case you have further queries, please quote the above reference number.

PLEASE NOTE: Research data should be securely stored in the discipline/department for a period of 5 years.

The ethical clearance certificate is only valid for a period of 3 years from the date of issue. Thereafter Recertification must be applied for on an annual basis.

I take this opportunity of wishing you everything of the best with your study.

Yours faithfully



.....
Professor Shenuka Singh (Chair)

/ms

Cc Supervisor: Professor Muhammad Hoque
Cc Academic Leader Research: Dr Emmanuel Mutambara
Cc School Administrator: Ms Zarina Bullyraj

Humanities & Social Sciences Research Ethics Committee

Professor Shenuka Singh (Chair)

Westville Campus, Govan Mbeki Building

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Telephone: +27 (0) 31 260 3587/8350/4557 Facsimile: +27 (0) 31 260 4609 Email: ximbap@ukzn.ac.za / snymanm@ukzn.ac.za / mohunp@ukzn.ac.za

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APPENDIX 14

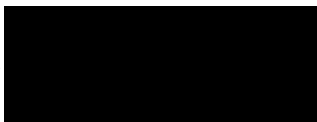
COLLEGE OF LAW & MANAGEMENT STUDIES

Change of Dissertation Title Form for Submission to HD&RC

Student Name	Renee Naidoo	No.	9502008
Name of School	UKZN - GSBL	Degree	DBAD
Supervisor	Dr Emmanuel Mutambara		
Co Supervisor	n/a		
Old title	DEVELOPING A PROJECT SELECTION MODEL TO SUPPORT INFRASTRUCTURE INVESTMENT PROGRAMS WITHIN THE PORTS AUTHORITY, SOUTH AFRICA		
New title	PROJECT SELECTION MODELLING FOR INFRASTRUCTURE INVESTMENT PROGRAMMES: THE CASE OF THE PORTS AUTHORITY, SOUTH AFRICA		
Reason for Change	Recommended by examiner		

NB: The change of title has not altered the subject matter or content of the dissertation in any way

Signature of Student.....Date 01 October 2020.....

Signature of Supervisor..........Date 30/09/2020.....

Signature of Co Supervisor.....Date.....

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Received by Faculty Office	Date
Sent to HD&RC Clerk	Date
HDRC Minutes:	Date
FB Minutes:	Date

APPENDIX 15

Turnitin Originality Report

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