RELIABILITY PROJECT OPTIMIZATION: A SOUTH AFRICAN RAIL CASE

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Abstract
The delivery of projects in the rail industry is a challenge. Transnet SOC Ltd (The South African national rail entity) is the sole bulk freight logistics rail company in South Africa. Transnet Capital Projects (TCP), a division of Transnet SOC Ltd, acts as a service provider to all the operating divisions of Transnet. TCP projects constantly failed due to what seemed like project integration challenges.

The purpose of this research is to determine Transnet's deficiencies and recommend solutions based on project management best practice in the field of railway engineering. This was achieved through the use of a questionnaire that was designed based on the lessons learnt, via an international best practice review, specific to railway projects. The research found that the major deficiencies lay within various levels within Transnet, specific issues being people and other issues being structural and technological. The research recommends a change in the TCP organizational structure, the recruitment of rail experts, skills development of project managers, the introduction of new railway software and the establishment of an Enterprise Project Management Office as potential international best practice solutions.

Keywords
Transnet, Rail, Projects, Project Reliability, Project Failure, Railway Projects

Introduction and Problem Statement
According to the Project Management Body of Knowledge (PMBOK), "A project is a temporary endeavour undertaken to create a unique product, service, or result" (Project Management Institute, 2013). In the context of railways, numerous organizations have applied the PMBOK philosophy in ensuring the successful delivery of rail projects (Xaba, 2011).

South Africa's (SA) freight logistics cost are at 12.7% of the country's GDP. This is relatively high in comparison to the rest of the world and can be attributed to the fact that South Africa has about 1% of the world population, produces 0.4% of the world's GDP and yet requires more than 2% of global freight in terms of ton-kilometres (Havenga & Simpson, 2013). This has brought about concern with the manner that rail projects are being executed in SA and the fact that the sole rail bulk freight logistics company in the country has announced an R300bn (USD 22bn) capital investment in rail projects over 7 years, calls for even greater concern (Transnet, 2013).

Transnet SOC Ltd is responsible for the movement of general freight and commodities in South Africa. Transnet Capital Projects (TCP), a division of Transnet SOC Ltd, is responsible for executing all the Capital Projects of Transnet's operating divisions. The operating divisions are Transnet Freight Rail (TFR), Transnet Pipelines, Transnet Property, Transnet National Port Authority, Transnet Port Terminals and Transnet Engineering.

TFR is responsible for all the railway operations and maintenance within Transnet but with rail project, TCP acts as a service provider to TFR.

The Transnet Strategy
Brian Molefe, The Transnet Chief Executive Officer (CEO) stated the following, "We are poised to become one of the world's largest freight logistics groups. The Market Demand Strategy projects Transnet's revenue grow from R46bn in 2011/12 to R128bn in 2018/19" (Transnet, 2013). Transnet embarked on the biggest project to date, this is known as the R300bn Market Demand Strategy (MDS) which aims to boost infrastructure development, job creation and investment in South Africa (Transnet, 2013).

Problem Statement

The successful execution of TCP rail projects and subsequent delivery of the MDS is a concern due to the fact that South Africa's current freight logistics costs are significantly higher than the world's when considering cost per ton-kilometre (Havenga & Simpson, 2013). Furthermore, between 2005 and 2011, 55% of all major rail projects in Transnet failed (Xaba, 2011).

Challenges constantly arose during the execution of TCP rail projects, particularly projects pertaining to project integration management. The reasons is be investigated in the current research, one of which could be the Transnet Capital Projects methodology for executing projects, or perhaps the implementation thereof.

Literature Review

A comprehensive, international literature review provided the basis of the research, specifically various international projects. Various components of the literature are extracted, specifically PMBOK aligned lessons learnt. The lessons learnt are clustered primarily according to either PMBOK knowledge area or PMBOK Process Groups as illustrated in Exhibit 1. The lessons learned are filtered and classified so as to develop questions and analysis per knowledge area or process group.

Exhibit 1: Link Between Literature and Methodology

Lessons Learnt from Literature	Case Studies
Scope Management in rail projects	• India Railways (Nag, Singh, & Tiwari, 2012)
Cost Management in rail projects during project lifecycle	• European Rail High Speed Rail Projects (Chevroulet, Giorgi, & Reynaud, 2012)
Cost Management in rail projects during asset lifecycle	• European Rail High Speed Rail Projects (Chevroulet, Giorgi, & Reynaud, 2012)
Quality Management	• European Rail High Speed Rail Projects (Chevroulet, Giorgi, & Reynaud, 2012) • Automated Copenhagen Metro (Chevroulet, Giorgi, & Reynaud, 2012)
Integration Management in rail projects.	• COWI Rail Projects (COWI, 2015) • Automated Copenhagen Metro (Pascoe & Ghiggi, 2004)
Organizational structure of railway organizations	• India Railways (Nag, Singh, & Tiwari, 2012)
Procurement in railway projects	• Taiwan High Speed Rail (Lu, Guo, & Pan, 2010)
Project selection and prioritisation in railway organizations	• European Rail High Speed Rail Projects (Chevroulet, Giorgi, & Reynaud, 2012) • Rail Projects in the USA (Kerzner, 2009)
Planning in rail projects	• India Railways (Nag, Singh, & Tiwari, 2012)
Risk management in rail projects.	• European Rail High Speed Rail Projects (Chevroulet, Giorgi, & Reynaud, 2012) • Automated Copenhagen Metro (Pascoe & Ghiggi, 2004) • COWI Rail Projects (COWI, 2015) • Taiwan High Speed Rail (Lu, Guo, & Pan, 2010)
Project closure in rail projects	• European Rail High Speed Rail Projects (Chevroulet, Giorgi, & Reynaud, 2012)
Project Management methodologies in rail projects	• European Rail High Speed Rail Projects (Chevroulet, Giorgi, & Reynaud, 2012) • Rail Projects in the USA (Kerzner, 2009)

European High Speed Rail Projects

The European projects considered are the Frankfurt-Cologne Intercity Express (ICE), the Channel Tunnel, the Oresund Fixed Link, the Paris-Lille Train Grande Vitesse (TGV), the Madrid-Seville Alta Velocidad Espanola (AVE) and the Lyon-Marseilles TGV. The European rail projects provided significant insight regarding the application of the PMBOK knowledge areas in railways, particularly Cost Management. Cost overruns occurred due to changes to the project specification, unforeseen changes in safety and environmental requirements, inadequate

budgeting, legal issues, political issues and underestimating land expropriation costs (Chevroulet, Giorgi, & Reynaud, 2012).

Life-Cycle costing is also a topic that is explored through the European rail projects. Poor or unreliable life-cycle costing is usually a result of unreliable demand forecasting, a lack of financial modelling skills, inadequate sensitivity analysis being carried out on financial models and project promoters knowingly embarking on rail projects that are not financially viable (Chevroulet, Giorgi, & Reynaud, 2012).

Taiwan High Speed Rail Project

Construction of the Taiwan High Speed Rail (THSR) began in March 2000 and commissioned in January 2007. The project connects Taipei and Kaohsiung, covering a distance of 345 km. The THSR procurement process proved to be exemplary to any multi-disciplinary railway project. The project applied a highly effecting procurement package plan and a well-structured procurement process. Some of the lessons learnt are that the scoring system devised for the selection of a successful bidder needs to be well crafted and designed to enable the employer to appoint the service provider which has all the required attributes in the required proportions. Secondly, an emphasis being placed on local as opposed to international contractors and consultants may be beneficial but tends to introduce numerous risks due to inexperience. Thirdly, a lack of contractors' inputs in bid documents is a common source of failed procurements and consultant being given adequate freedom to use their expertise can prove beneficial for the project. Lastly, preference being given to low prices as opposed to overall value introduces significant risk of failed project delivery. Rail projects are also much better executed when not fragmented into too many packages because it limits the risk failed interface management (Lu, Guo, & Pan, 2010).

Automated Copenhagen Metro - Denmark

The Copenhagen Metro is one of approximately 70 Automated People Mover Systems in operation throughout the world, commissioned in 2004, happened to be one of the most intense in terms of complexity. Apart from the application of effective project phasing, other lessons can be drawn from the Copenhagen Metro. Two knowledge areas can be discussed based on the literature for the Automated Copenhagen Metro, specifically Risk Management and Quality Management. In ensuring quality of work, the Automated Copenhagen Metro employed very experienced multidisciplinary teams with the awareness of the complexities that accompanied such rail projects (Pascoe & Ghiggi, 2004).

Two lessons can be learnt specific to Risk Management. The use of simulation tools and modelling tools are critical for successful risk management on complex rail projects. These tools offer insights that cannot be achieved through conventional risk management processes (Pascoe & Ghiggi, 2004).

Mombasa to Kampala Line Bridge Study - Africa

The study is performed on the 700 km, single track main railway line from Mombasa in Kenya to Kampala in Uganda. The study was carried out in 2006, with a project value of EUR 3.8 million. The inclusion of relevant stakeholders proved to bear on the quality management of the project. The lessons learnt are Stakeholder Engagement is that critical activities need the involvement and input of all interfacing disciplines. The requirements of all relevant stakeholders need to be integrated into specific activities and open communication needs to be facilitated. Stakeholders downstream of the projects also need to be engaged (The Independent Reporters , 2009).

Project Management in India Railways

India Railways (IR) experienced significant growth from 1950 to 2011 as it moved from having 59 000 kilometres of track to having 114 000. IR also increased its freight traffic from 38 billion ton-kilometres to 636 billion ton-kilometres in the same period. Where IR’s passenger rail is concerned, an increase from 67 billion passenger-kilometres to 978 billion passenger-kilometres is realized (Nag, Singh, & Tiwari, 2012).

IR demonstrated that the choice of a Project Management Structure for any railway organization is critical as an incorrect choice can lead to time and cost overruns. Lessons are also learnt from the previous shortfalls of IR, particularly pertaining to Scope Management and planning of rail projects. Some of the lessons include the fact that insufficient time being allocated to planning leads to poor project delivery, the client not having an appreciation for project planning can have an adverse effect on project deliverables, a lack of planning skills within the project team most likely leads to inadequate and impractical plans and that insufficient resources allocated to planning can hamper project timelines and delivery.

IR further indicated that the most common reasons for failure in managing the scope of rail projects are unclear client expectations, unrealistic client expectations, a lack of skills by individuals responsible for project deliverables, an inadequate change management process and scope creep (Nag, Singh, & Tiwari, 2012).

Research Methodology

Questionnaire Design

The research assimilates the lessons learnt from the international literature review. These lessons learnt are integrated into a comprehensive questionnaire structured so as to test the state of projects at Transnet relative to lessons learnt from the literature.

Mixed Methods Research Questions

The current research utilized a combination of qualitative and quantitative research methods which is known as Mixed Methods Research. Mixed Method Research questions have both qualitative and quantitative elements within the same question.

Mixed Methods research is a creative form of research that can be very useful when attempting to study a limited number of cases in depth or when attempting to describe complex phenomena. It is for this reason that this method is applicable for the current research. The research aims to look at the application of the PMBOK knowledge areas in depth, particularly in the rail environment (Sandelowski, 2000).

Data Validity

Fluid Surveys, this online tool, is used to collect data for this research. This allows the researcher to design a questionnaire so as to ensure data validity. Should the desired response for a specific question be limited to a number within a stipulated range, as is the case for the current research, then an error message is returned in the case where a questionnaire respondent entered in an invalid response (Zohrabi, 2013).

A practical protocol in securing data reliability is a repeat scenario. A question can be asked more than once in different ways since reliability is meant to measure consistency (Zohrabi, 2013). The current research tests data reliability through cross-checking the responses for specified questions. The consistency of the responses is checked by testing a specified concept in more than one question.

Data saturation entails acquiring questionnaire responses until the results start becoming redundant and there is nothing else left to learn. Knowing where this saturation point lies is critical when conducting qualitative research as a researcher needs to know how much data is sufficient (Marshall, Cardon, Poddar, & Fotenot, 2013).

In a study done by (Marshall, Cardon, Poddar, & Fotenot, 2013), most scholars recommend 20-30 questionnaires for quantitative studies while a few others recommend 30-50. Thomson (2002) stated that "theoretical saturation generally occurs between 10 and 30 questionnaires. Thus, this research anticipated 30 questionnaires in order to facilitate pattern, category, and dimension growth and saturation" (Thomson, 2002).

The questionnaire focused on a sample of 50 rail professionals within TCP and TFR with the purpose of retrieving 30 valid responses, assuming a 60% response rate. These are individuals that deal with rail projects on a daily basis within Transnet and are more than capable of suggesting ways in which TCP can increase the reliability of its rail projects (Marshall, Cardon, Poddar, & Fotenot, 2013).

Data Interpretation

The interpretation of the data includes a process of data segmentation in order to make the most reliable recommendations. The responses between TCP and TFR are separated and compared to each other. A similar process of data segmentation, carried out for the TCP departments and for different qualification levels of the respondents. The data is also analysed both qualitatively and quantitatively as previously stated. Based on the most popular answers amongst the rail professionals, recommendations are made on how to improve the reliability of rail projects in TCP (Goldstein, 2010).

Ranking System

A ranking system is developed with the aim of determining the most critical deficiencies in TCP rail projects. Ranking is appropriate in such instances where the hierarchy of options needs to be established which then informs as to which items TCP needs to pay attention to (Fabbris, 2013).

A great advantage of ranking is that two rankings of the same set are directly comparable. This isn't the case with rated data since it involves some subjectivity (Stoyanovich, Jacob, & Xuemei, 2015). Ideally, the population of ranked data should have three key characteristics which are demonstrated for the current research. These are Domain Diversity, Diversity of Opinion and Locality of Agreement. The data for the current research has all 3 of these characteristics as indicated in the chapter to follow. Domain Diversity refers to the objects under investigation being ranked by different kinds of users while Diversity of Opinion refers to the same items being ranked differently by different groups of participants. The last characteristic, Locality of Agreement, refer to there being a level of consensus between groups of participants (Stoyanovich, Jacob, & Xuemei, 2015). The fact that the current research follows a process of data segmentation enabling the demonstration of Domain Diversity, Diversity of Opinion and Locality of Agreement. "Let r_j^i be the rank of algorithm *j* on dataset *i*. The average rank is calculated using Equation (1).

$$r_j^t = (\sum_t r_j^t)/n \tag{1}$$

Where *n* is the number of datasets. The final ranking is obtained by ordering the average ranks and assigning a rank to the algorithms accordingly" (Bradzil & Soares, 2000). Given the data analysis approach employed by Bradzil & Soares (2000), the current research ranked the objects in question according to average rank as part of the data analysis.

The analysis further tested the agreement between ranks by utilising Kendall's Coefficient of Correlation and the Coefficient of Concordance. The agreement between two different rankings can be measured Kendall's Coefficient of Correlation (τ). τ ranges from -1 to 1, -1 signifying total misalignment and 1 signifying complete alignment between the rankings (Rider, 1952). The formula for Kendall's Coefficient is illustrated in Equation (2).

$$\tau = \frac{S\tau}{1/2n(n-1)} \tag{2}$$

The measure of agreement between several rankings can also be calculated using the Coefficient of Concordance (*W*). *W* ranges from 0 to 1, 0 showing the highest degree of disagreement and 1 signifying complete agreement (Rider, 1952). The formula for the Coefficient of Concordance is illustrated in Equation (3).

$$W = \frac{12\,Sw}{m^2 n(n+1)(n-1)} \tag{3}$$

The use of this method of analysis is applicable in both homogenous and heterogeneous ranks of varying numbers of rankings. This is ideal for the current research as the data is homogenous but the different questions in the questionnaire vary in number of rankings (Stoyanovich, Jacob, & Xuemei, 2015).

For the sake of making the analysis efficient, attention is mainly given to the responses that ranked above average. This is based on the Pareto Principle which implies that fixing 20% your extreme problems can lead to an 80% improvement. The Pareto Principle can lead to great returns for very little effort (Kaplow, 2005).

Results and Discussion

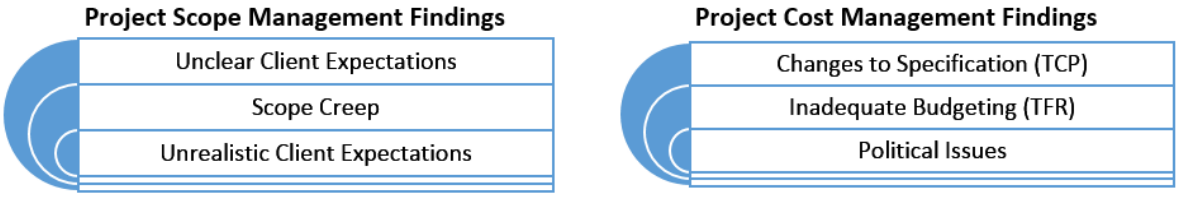
Project Scope Management Findings

The greatest issue that affects the reliability of scope in TCP rail projects is unclear client expectations. Second to unclear client expectations is Scope Creep. Should these two deficiencies be dealt with, the reliability of scope delivery in TCP rail projects can be increased significantly. The questionnaire revealed that a lack of time allocated to planning could be a key cause of TFR's scope tending to be unclear.

Project Cost Management Findings

TCP and TFR both agreed that changes to the project specification are a key problem. According to TCP, this is the outright primary cause of cost overruns. TFR, however, suggested that the primary cause of cost overruns is inadequate budgeting. This is probably due to the fact that TFR is responsible for the project specification and its associated changes while TCP is responsible for budgeting. Exhibit 2 displays the findings.

Exhibit 2: Cost and Scope Management Findings



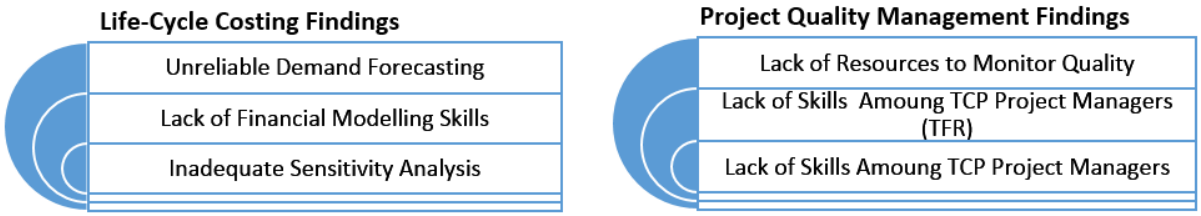
Life-Cycle Costing Findings

Both TCP and TFR seemed to agree that unreliable demand forecasting is the primary cause of TCP rail projects not realizing their planned benefits. Clearly TFR is aware that their demand forecasting tends to be unreliable, possibly because project promoters tend to have optimistic forecasts and intentionally try to make project seem viable on paper (Chevroulet, Giorgi, & Reynaud, 2012). Another reason could be a lack of time allocated to planning as previously discussed. As a result of time pressure being exerted on TFR, their financial forecasts may become unreliable. Exhibit 3 displays the findings.

Project Quality Management Findings

TCP and TFR are in agreement in that a lack of resources to monitor and control quality is a major reason for defects in project deliverables, however, TFR is of the opinion that an even greater reason for defects is a lack of skills by TCP and its service providers. A departmental segmentation of the TCP results revealed further insights. It proved that the lack of skills primarily lies within the Project Management department within TCP.

Exhibit 3: Life-Cycle Costing and Quality Management Findings



Project Integration Management Findings

TCP results indicate that the greatest issue with project integration management is the lack of integration champions in TCP rail projects. The data from TFR indicated that a lack of skills among TCP project managers is part of the problem when integration is considered. TFR is not involved in the day to day running of the project which could be the reason for an integration champion not been envisaged. The TFR response however, supports previous findings which suggests that TCP project manager are indeed ill-skilled.

TCP Organizational Structure Findings

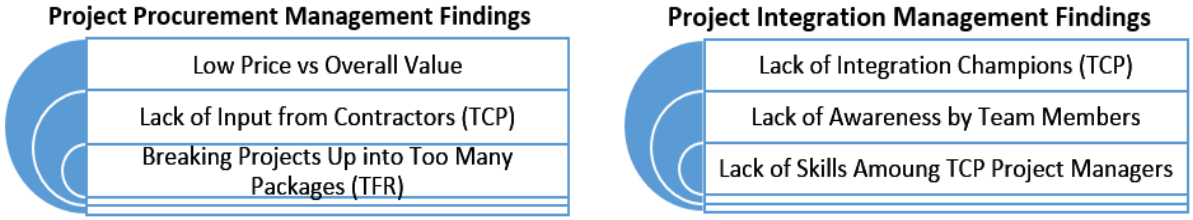
Both operating divisions indicated that some of the challenges faced by TCP rail projects can be mitigated by a change from a Matrix to a Pure Project organizational structure.

Project Procurement Management Findings

The leading cause of failure in procurements in TCP rail projects is that TCP values low price as opposed to overall value. TCP's scoring system would need to be restructured such that value is given priority over price. For TFR, the second most popular response is the notion that TCP breaks projects up into too many packages and as a result, compromises the reliability of project procurements. This is probably due to the fact that TFR often has a programme manager interfacing with project managers which may get frustrating from a TFR point of view. Given that TCP deals with the detail of projects, breaking it down into smaller packages is warranted. It seems then that the issue is that TCP reports to the client in a fragmented manner instead of having a consolidated reporting system to TFR.

TCP data indicated that a lack of input from contractors in the bid document and the fact that contractors are not given adequate freedom to exercise their expertise are other issues that cause problematic procurements. TCP probably had this view because consultants tend to be more updated where the latest technologies are concerned. Consultants having input into bid documents can ensure that the best methodologies are implemented in the execution of the project which may be great for saving time and money (Lu, Guo, & Pan, 2010). Given that TCP is primarily responsible for the timeframes and budgets that it commits to, it's critical for them to be as innovative as possible in executing their scope, hence their increased desire to have consultants' inputs. Exhibit 4 displays the findings for both procurement and integration management.

Exhibit 4: Procurement and Integration Management Findings



Project Initiation Findings

Only 15% of TCP respondents indicated that Transnet terminates potentially beneficial projects because it limits project selection to cost/benefit analysis but half of the TFR respondents indicated the same. This entails a difference of 35% between the divisions' results and is most likely due to the fact that TCP doesn't have a full view of the projects that TFR terminates.

Project Planning Findings

According to TCP, the primary reason for poor planning in TCP rail projects is the fact that the client (TFR) doesn't have an appreciation for project planning followed by the fact that insufficient time is allocated to planning. TFR agreed with the latter but not the former. As previously mentioned, in the opinion of TFR, the two primary reasons for poor planning are insufficient times being allocated to planning and a lack of planning skills within the TCP project team, echoing the same sentiments of previous results.

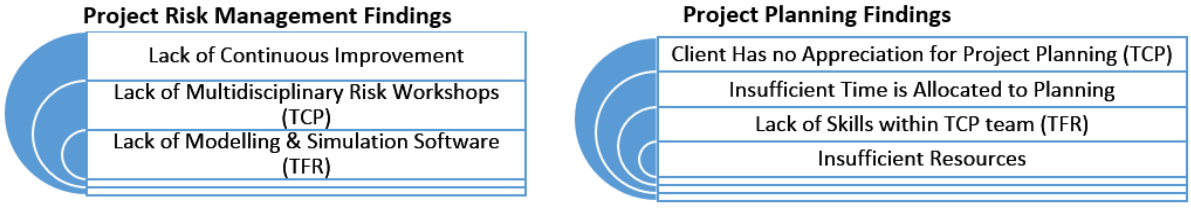
Both TCP and TFR are in relative agreement that insufficient resources being allocated to planning is a cause for moderate concern. It appears as though resource problems are a general issue within TCP since previous analysis revealed that the TCP project management team blames poor quality and integration on a lack of resources. This problem can also be attributed to the project structure utilized by TCP. Exhibit 5 displays the findings.

Project Risk Management Findings

Specific to risk, the primary cause of failure seems to be the lack of a continuous improvement philosophy in TCP rail projects. TCP, though, believed that one of the greatest causes of failed risk management is the lack of multidisciplinary risk workshops. This can be seen in Exhibit 5.

TFR is also of the opinion that along with the lack of a continuous improvement philosophy, the lack of modelling and simulation software and the failure to execute pilot phases of projects are amongst the biggest causes that lead to poor risk management in projects. TFR's response was logical as the work is in an operations environment. Their primary concerns are to do with operations and volume throughput. TFR not meeting projected volumes is one of the biggest risks and given that these are the clients, these risks should be received with a greater appreciation, by TCP. A project may be well executed from a capital expenditure point of view but if it doesn't meet its life-cycle cost projections, it can be considered to have failed (Nikou & Koltz, 2011).

Exhibit 5: Project Planning and Risk Management Findings



Project Closure Findings

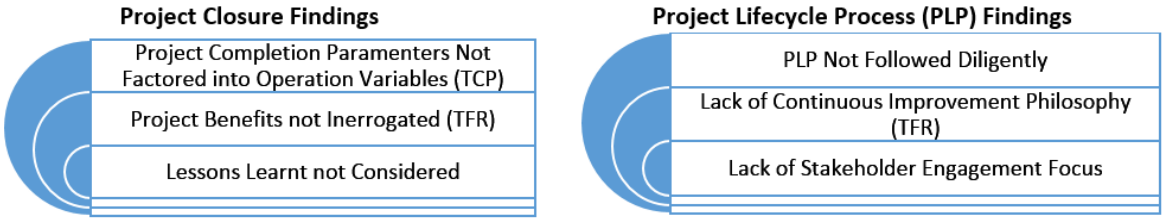
TCP suggested that project parameters at completion are not factored into operations variables which compromises project closure. TFR, on the other hand, is convinced that the greatest cause of poor project closure is that the benefits that are meant to be realized by the project are not interrogated. The difference in opinion is probably caused by the fact that TCP hands the project over to TFR and is not involved in monitoring the benefit thereafter.

Project Lifecycle Process (PLP) Findings

TCP is of the view that The PLP is not followed diligently enough and isn't enforced within TCP which is the biggest issue the PLP is concerned. The two divisions showed alignment in this regard so action would therefore definitely needs to be taken. 50% of TFR respondents believed that the PLP doesn't embrace a philosophy of continuous improvement. This has been demonstrated in Exhibit 6.

A departmental segmentation of the results is performed which revealed valuable information. Individuals with Diplomas confirmed that Stakeholder Engagement is an element of the PLP that's lacking or rather aren't being engaged enough in activities that affect and require input.

Exhibit 6: Project Closure and PLP Findings



Summary of Findings

The results and analysis thereof revealed volumes where the reliability of rail projects in TCP is concerned. The synthesis of qualitative and qualitative data analysis enabled the research to reveal the depths and extents of the issues that lie in Transnet rail projects. Various issues are of concern, some of the key ones seemingly being integration related. In dissecting integration further, specific issues seem to be of particular concern. Stakeholder Engagement is one of the issues that has led to a deficiency in integration of rail projects in TCP but the primary issue seems to be the skills of individuals in charge of project integration.

Recommendations & Conclusion

The results and analysis revealed volumes where the reliability of rail projects in TCP is concerned, particularly regarding project integration. The following recommendations are based on the results previously discussed and seek to remedy the most critical deficiencies of Transnet rail projects.

Inadequate Planning

Given the amount of pressure that the Transnet CEO's mandate places TFR under, it leads to there being a lack of time allocated to planning which results in unrealistic and unclear expectations from TCP. Unclear expectation further result in scope creep throughout the duration of the project. This further leads to the TCP project management team failing to deliver on its project requirements and therefore seeming incompetent.

The problem needs to be solved from the top down since the root cause is the unrealistic mandate given to TFR. The goals cascaded down by management need to take cognizance of the intensity level that TCP and TFR have previously been operating under. If the Transnet executive management aim to roll-out a high-pressure infrastructure expansion programme, it should do so gradually and allow the current TCP and TFR staff to adjust to working at high intensity levels while also increasing the resources and skill capabilities of the two divisions.

TCP Organizational Structure
Executive management should also change the TCP organizational structure such that it supports the delivery of projects. If the MDS is to be achieved timeously, the project structure needs to be such that project teams can easily be established and key projects have dedicated resources (Kerzner, 2009).

TCP Project Management Staff
The problem of ill-skilled staff members can be solved in two ways; the recruitment of competent project managers and the training of individuals that are currently in the organization. The new project managers need to not only rescue the project execution of key rail projects but offer support and skills transfer to the less skilled project managers. The training of the Project Managers should have a particular focus on Project Integration and Stakeholder Engagement as these are the areas that where TCP project managers are seemingly challenged. In further improving project integration in TCP rail projects, TCP should begin hiring integration champions which are specialist systems engineers with a railway background (Kerzner, 2009).

TCP Systems
The introduction of highly skilled rail professionals should further allow the selected professionals to have an input in the systems and rail software to be used by the organization. The professionals can also be involved in the training of TCP employees in the use of the relevant software and technologies. An example of software that could be introduced is BIM (Building Information Modelling) software.

Enterprise Project Management Office
The introduction of an Enterprise Project Management Office (EPMO) may prove to be beneficial (Patel, Patel, & Patel, 2012). The EPMO operates at a strategic level and is therefore more effective in aligning the strategic goals of the organization with project goals. One of its major roles is to improve the business processes across the organization and implement the use of new systems. The use of BIM, as previously discussed, can be implemented by the EPMO (Andersen, Henriksen, & Aarseth, 2007).

Procurement
Instead of fragmenting projects unnecessarily and compromising the success of projects, TCP could ensure that big contracts, which are awarded to global railway leaders, have strict requirements when coming to empowering local companies. TCP should further allow service providers the flexibility to best apply their expertise.

Summary and Conclusion
The major issues that lead to project failure in TCP rail projects are uncovered by the current research. The major deficiencies lied within various levels within Transnet, some of them being people issues and some of them being structural and technology issues. In an attempt to achieve the maximum possible output for the least effort, recommendations are given for the major deficiencies which entails a change in the TCP organizational structure, recruitment of rail experts, skills development of project managers, introduction of new railway software and the establishment of an Enterprise Project Management Office.

Recommendations for Future Research
Future researchers could further investigate the improvement of TCP's recruitment, selection and training processes, particularly that of project managers. Additional research could also consider the practical application of BIM software in TCP along with the optimizing of the Transnet Group organisational structure.

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