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Functions of Project Steering Committees in Large Capital Projects

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Abstract

Large Capital Projects (LCPs) have a significant impact on the growth and development of local and international economies. Their failure stagnates progress, is not sustainable and cripples the economy and society in which they exist. This research study investigated the effective functioning of a Project Steering Committee (PSC) as a pivotal component to project management. Based on the findings of the literature review, the research model consists of four PSC function categories: (i) configuration, (ii) competency, (iii) decision authority, and (iv) communication. A 5-point Likert scale survey was used, and the results from 46 respondents within the South African industry was analyzed.

The results concurred with previous studies that PSCs' knowledge of Structured Corporate and Project Governance is essential for the efficient functioning of a steering committee. Contrary to the expectations of experienced project practitioners, Communication Management ranked relatively low in importance. Whilst there was consensus on the ratings of the PSC competencies, the variance noted can be attributed to factors such as the project experience of participants, the type and location of the project, and the PSC construct in different organizations. This can indicate that there is no single PSC attribute, but a combination of technical and interpersonal skills, necessary for effective PSC functioning.

Based on the results, it is recommended that the roles and responsibilities of the PSC are confirmed and understood by project stakeholders early in a project to ensure clear guidance and authority.

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1. Introduction

LCPs account for 8% of the global gross domestic product (GDP), hence their success or failure can either drive economic development or hinder it [1]. In recent times, LCP failure rates have resulted in unnecessary wasteful expenditure on resources, with the International Herold Global Projects database estimating that on average LCPs exceed their budget by 80% and schedule by 20 months past the planned date of implementation [2]. In South Africa, the national power utility Eskom recently completed two new build projects: Medupi (4764MW) and Kusile (4800MW) Power Stations. Both projects experienced delays and cost over-runs of more than 100% affecting the business viability of the organization that has resulted in exorbitant increases in electrical tariffs [3]. This poor project performance occurred despite the availability of many advanced project management tools and techniques.

The continued project failures require a pursuit to improve project practices beyond operational and tactical levels. Whilst, the PSC operates at a strategic level, its function and influence on project performance necessitate further investigation. Concurrently whilst, PSCs are acknowledged as important structural elements in project success and are widely discussed in literature, there is a research gap in emphasizing the functions and, roles and responsibilities that PSCs have in the project environment [4]. Thus, the objective of this study is to identify the key functions of a PSC that will help steer LCPs towards success.

2. Literature Review

2.1 LCPs Performance

Projects are important mechanisms for achieving organizational strategic goals [5]. LCPs whilst complex, have a long-term impact on the economy, the environment, and the society in which they exist [6]. The anticipated total global LCP spend was measured between US\$6 to US\$9 trillion in 2015 and is expected to drastically increase [1]. The Da Vinci Institute expects LCPs to increase to 24% of the global GDP by 2030 [7]. This acceleration in LCPs cost and magnitude can be attributed to economic growth that has increased infrastructure demand [8].

However, historically the performance of LCPs has been problematic, with global examples indicating cost overruns between 50% to 1900% [9]. This acceleration in LCP growth requires the successful implementation of these projects to secure the sustainability of both international and local economies, society, and the environment. Previously, the success of an LCP was assessed when the project had reached its goal in terms of cost, time, and quality/performance [10]. However, other factors such as sustainability, social acceptance, and environmental impact have become more pertinent [11]. To address all these factors, the active intervention and involvement of senior management is important. Studies conducted by Independent Project Analysis (IPA) into downstream projects confirmed that PSC's involvement in capital projects is paramount in achieving project success [11].

2.2 Function of the PSC

The PSC is described as a decision-making body that meets regularly to review projects and make decisions that include screening projects at gates, prioritization and selection or termination of projects [12]. Hence, PSCs have been acknowledged as a pivotal structural element in project management that impacts project performance [12]. Whilst PSCs are considered pivotal structural elements, it is imperative to note that PSC members are not necessarily involved in a project full-time but are more likely to provide guidance and oversight in decisions and adherence to governance policies [13].

Research conducted by the PMI in 2014 [10], revealed that having an active PSC is the top driver of project success. However, [14] noted that less than two-thirds of projects have an effective PSC suggesting that organizations do not appreciate the value of PSCs. Furthermore, [3] established that on average 38% of projects do not have active PSCs and that most companies lacked strong project sponsorship, this was attributable to senior management who did not understand the PSC's role in upholding project governance and its influence on project performance.

According to [14] a cross-functional steering committee that comprises well-experienced and knowledgeable members ensures top management support and improves the quality of decisions and validity of project data. A similar sentiment was echoed in a study by [15] where it was highlighted that organizations with steering committee members who frequently show all five of the following skills have better project performances: The ability to influence stakeholders, The ability to work across different stakeholder groups to find win-win solutions, Leadership, Decision making and Effective communication.

Although PSCs may impose positive influences as mentioned above, they could also impose negative effects on projects by delaying important implementation decisions as well as instigating organizational conflict [4]. This can be attributed to the PSCs' lack of understanding of their function, incompetence regarding their skill sets, and/or lack of knowledge of project governance [4]. It is important to identify the main functions, information required, and even core competencies of a PSC to ensure the committee is well equipped to steer the project team towards project success.

3. Conceptual Model

This study is based on an integrated version of four separate models from researchers [4], [12], [14], and [16]. Their studies investigated the role of a PSC as a success factor for LCPs and highlighted the following variables for project success:

- Project success as a function of PSC configuration, responsibility, decision authority, organization (communications), committee processes [4].
- Project success as a function of PSC configuration and decision processes [12].
- Project success as a function of communication, consolidation, and negotiations and, decision making [14].
- Project success as a function of project management, project procedures, human factors, project-related factors, and external issues [16].

The proposed research model for this study is depicted in Fig. 1 below and includes four functional categories namely (i) configuration, (ii) competency, (iii) decision authority, and (iv) communication.

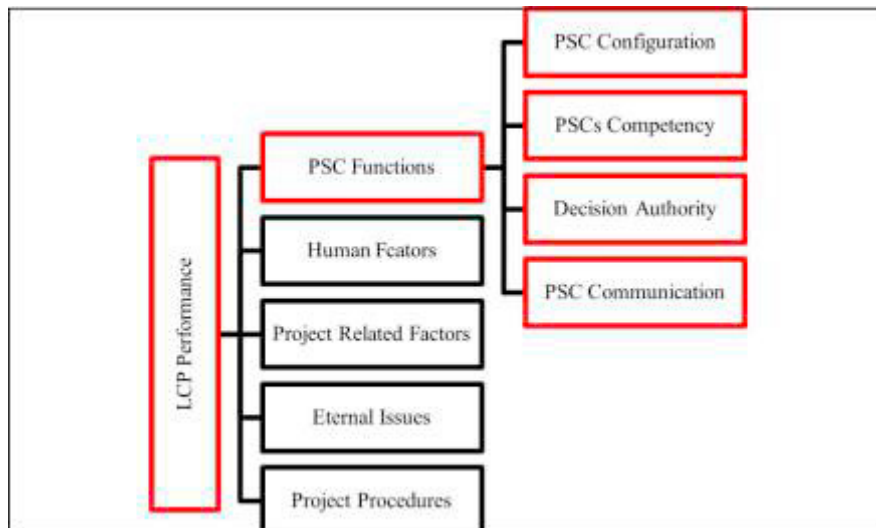


Fig. 1 Integrated Study Model (with current study focus areas highlighted)

4. Research Design

This study focused on PSCs of large capital investment projects within major South African industrial sectors. These sectors included agriculture, infrastructure, FMCG, energy/power, mining, petrochemical, oil, and gas, as well as pulp & paper. The research design followed a mixed-method approach combining semi-structured interviews and a questionnaire. To initially compile the draft questionnaire existing literature by [4], [14], and [17] was used. Following this, interviews were conducted with senior industrial management with over 15 years of experience in project management. During these interviews, the draft copy of the questionnaire was used as a discussion guideline, after which the data collated from the interviews were used in the refining of the questionnaire.

4.1 Research data

The online questionnaire was developed with the Qualitrics™ software. To protect the interest of the research participants and the integrity of the research results (accuracy and no bias) the key principles of ethical considerations identified by [18] were applied. The general information of respondents was consolidated in the first section of the Questionnaire i.e., Questions 1 to Question 5. The four constructs identified in the conceptual model contained the questions and sub-questions, for which some included ranking (Table 1).

Table 1 Questionnaire Structure in relation to the Conceptual Model

Conceptual Model	Categories	Survey Questions
PSC Functions	Configuration	Q6, Q7, Q8, Q9, Q14, Q15, Q16, Q17
	Decision Authority	Q11, Q12
	Competency	Q10, Q18, Q19, Q20, Q22
	Communication	Q24, Q25, Q26, Q27

The survey comprised of ranking and ordinal scale data. Ranking of data was incorporated to determine the level of importance of some PSC functions, as perceived by the participant. Whilst ordinal scales were used to analyze survey responses, Likert response “To a very low extent and Strongly disagree” were associated with a numerical value 1, whilst “To a very high extent/ Strongly agree” was associated to the number 5.

The central tendency and variability of the Likert type data was determined by the mode and the frequency of responses. For Likert scale data that measured a construct, the central tendency and variability were determined by the mean and standard deviation, respectively. It was proposed by [19] that due to the ordinal non-parametric nature of the data; Friedman analysis and Cronbach’s Alpha analysis at a significance level of 0.05 (5%) is required. The Phi coefficient was also calculated to measure the strength of association between variables [19].

5. Survey Results

5.1 Semi-structured interview data

The interviews highlighted the following additional functions to be included in the questionnaire: Ensure that all projects are correctly prepared, motivated, reviewed, approved, controlled, and recorded; Willingness to accept “bad news” from the project team; Quick decision making; Active problem solving.; Practical application (“Walk the talk”).

The consolidated web-based questionnaire was sent to 11 South African organizations across various industries. The questionnaire was administrated over 2 months. Collectively, 51 responses were received of which 5 were incomplete questionnaires. The 46 completed responses were used in the analysis.

5.2 Configuration

From the data obtained, there was a clear consensus that most of the organizations surveyed had a PSC comprising multi-disciplinary committee members, allowing for a holistic analysis of the project (Table 2). The Chi-square best

fit analysis ($P < 0.05$) also confirmed that the sample data observed followed a particular distribution, different from the expected equal distribution, validating the reliability of the data.

Table 2: Cross-functional PSC

Survey Question	Item	Mode	Descriptive Mode	Chi-square P Value
6	PSC consist of multidisciplinary committee members.	5	Strongly Agree	1.64E-09
7	A cross-functional PSC enables a holistic analysis of the project	5	Strongly Agree	1.37E-10

Table 3 below summarizes the survey responses to variables related to the PSC's involvement in project phases and its influence on project scope, schedule, and cost. The overall mode of 4 shows that there was agreement that the PSCs were involved in the front-end and execution phases of the project. However, the participants' response to the PSCs influences on scope, schedule and cost varied significantly preventing any constructive conclusion on the data. To determine the PSCs involvement in project phases and its impact on project success, the Phi Coefficient test was conducted. The results yielded Phi coefficient values that ranged between -0.17 and 0.07, which infers no significant relationship between variables mentioned above.

Table 3: PSC's involvement in project phases-variables (overall response)

Question	Variable	Mode	Phi Coefficient
8	PSC actively involved in Front-End-Loading (FEL) phase	4	0.02
9	PSC actively involved in the execution phase	4	0.07
14	PSC played a significant role PRIOR to capital approval	4	-0.05
15	PSC influenced scope change	2	-0.15
16	PSC influenced schedule change	4	-0.17
17	PSC influenced cost	4	-0.05

5.3 Decision authority

The PSC's Decision Authority in relation to project success was investigated by considering the organizational PSCs roles and responsibilities and their influence on project performance.

The overall central mode of 4 showed that there was agreement amongst respondents that the PSC roles and responsibilities were defined at the onset of the project. There was also agreement among participants that the PSC prioritized projects based on the business needs, refer to Table 4. However, the Phi Coefficients of -0.11 and -0.04 showed that the study did not establish any significant correlation between the variables and project success, consequently no formidable conclusion could be drawn.

Table 4: PSCs Roles and Responsibilities

Question	Item	Mode	Descriptive Mode	Phi Coefficient
11	Roles and responsibilities of PSC members clearly defined	4	Agree	-0.11
12	Projects are prioritized by the PSC based on business needs	4	Agree	-0.04

5.4 Competency

The PSC's function and core competencies were identified in order of most to least importance. This analysis was conducted to identify the key functions and competencies of the PSC to ensure the committee is well equipped in making informed decisions during the lifecycle of the project.

Table 5 lists a set of key PSC functions compiled from literature and from this study's semi-structured interviews. This was presented to the survey respondents for their ranking in order of importance in Question 10 of the Survey.

Table 5: Proposed PSC functions

Function label	Function definition	Function label	Function definition
Function 1	Provides input to the development of the project,	Function 6	Provides effective and timely decision making
Function 2	Resolves conflicts between stakeholder groups.	Function 7	Custodian of project governance.
Function 3	Provides steering on budget, schedule, and quality.	Function 8	Review project performance
Function 4	Identifies project priorities.	Function 9	Manage and ensure that all projects on site are correctly prepared, motivated, reviewed
Function 5	Identifies and monitors potential risks.	Function 10	Open to hearing “bad news”

Based on the calculated modes of the survey responses, the top 5 highest ranked functions were: Function 7 (1st), Function 1 (2nd), Function 3 (3rd), Function 5 (4th) and Function 6 (5th). The 3 lowest ranked functions were: Functions 2 (8th), Function 9 (9th) and Function 10 (10th), respectively.

The analysis was further extended to explore the ranking of PSC functions in relation to participants’ experience level (Table 6). It was observed that participants with less than 10 years of experience rank project management (Function 9) and project reviews (Function 8) above functions related to risk identification (Function 5), and decision making (Function 6). Furthermore, the Friedman coefficient ($F(r) < 0.05$) indicates that the difference in the rankings is statistically significant and is not due to chance alone.

Table 6: PSC Key Functions Ranked in Order of Importance (1: High, 10: Low)

Age group	≥ 10 years		< 10 years		Overall	
Key Functions	Function 7	1	Function 7	1	Function 7	1
	Function 1	3	Function 1	1	Function 1	1
	Function 4	4	Function 9	2	Function 3	3
	Function 5	4	Function 3	3	Function 5	3
	Function 2	5	Function 8	4	Function 6	6
	Function 6	6	Function 5	6	Function 4	8
	Function 3	7	Function 6	7	Function 8	8
	Function 8	8	Function 4	8	Function 2	9
	Function 9	9	Function 2	9	Function 9	9
	Function 10	10	Function 10	10	Function 10	10
F(r)	2.28E-28					

Tables 7 below summarizes the extent to which PSCs understand their organizational and project governance policies, and the project life cycle process. The overall mean of 3.85, indicates that most respondents believed that their PSC understands their organizational and project governance policies, and project life cycle processes. In addition, the Cronbach alpha coefficient was greater than 0.7, showing that the set of variables, are reliable in measuring the construct- PSCs understanding of Processes and Policies.

Table 7: Latent Variable: PSC's Understanding of Processes and Policies

Question	18	19	20
Variables	PSC's understanding of their organisations' governance policy.	PSC's understanding of its project governance policy.	PSCs understand the project life cycle and its process.
Mean	3.95	3.90	3.80
Cronbach's alpha	0.71		
Overall Mean	3.85		

A set of key PSC competencies was compiled using existing literature by the following researchers: [12], [13], [14], [15], [17] and [20] as well as from the semi-structured interviews. Table 8 below summarizes the 14 competencies identified. This list compilation was presented to respondents for their ranking in order of importance.

Table 8: PSC Competency defined

Competency	Definition	Competency	Definition
Competency 1	Stakeholder Management.	Competency 8	Structured Corporate and Project Governance
Competency 2	Conflict Management	Competency 9	Resource Management
Competency 3	Risk Management	Competency 10	Time Management
Competency 4	Negotiation Skills	Competency 11	Communication Management
Competency 5	Decision Making	Competency 12	Quality Management
Competency 6	Practical Field Application	Competency 13	Problem Solving
Competency 7	Project Management	Competency 14	Cost Management

Based on the calculated modes of the survey responses, the five highest ranked competencies were: Structured corporate and Project governance (1st), Stakeholder management (2nd), Project management (3rd), Decision making (4th) and Negotiation skills (5th). The five lowest ranked competencies were Time management, Communication management, quality management, problem solving and lastly cost management.

The analysis was further extended to explore the ranking of PSC competencies in relation to participants experience. It was observed participants with less than 10 years of project experience ranked soft competencies (Decision Making and Practical Field Application) of the PSC more important than technical competencies. The Friedman coefficient ($F(r) < 0.05$) also shows that the difference in the rankings is statistically significant.

5.6 Communication Management

Tables 9 below summarizes the survey results on the PSCs Communication Management in relation to project performance. An average mode of 3.83 and 4.00 shows that PSCs met frequently, managed meeting minutes well and made sound decisions with limited information. A clear correlation between project performance and good PSC communication and information processing can therefore not be determined from the results. In addition, it was observed that respondents, who based their responses on an unsuccessful project, had a lower mean (3.40) response to the criteria for reporting project status and risk. The Cronbach alpha coefficient for successful and unsuccessful scenarios were greater than 0.7, indicating that the set of variables are reliable in measuring the PSC's communication management construct.

Table 9: Latent Variable: PSC's Communication (Survey answers based on a Successful and Unsuccessful Projects)

Question	24	25	26	27
Successful Project				
Mean	3.98	3.98	3.50	3.86
Mean Latent Variable			3.83	
Cronbach's alpha			0.74	
Unsuccessful Project				
Mean	4.20	4.40	3.80	3.40
Mean Latent Variable			4.00	
Cronbach's alpha			0.80	

6. Discussion

The results highlighted that PSCs in most industrial sectors in South Africa constitute multidisciplinary committee members, which allows for a holistic analysis of projects. The LCP's environmental and socio-economic impact could be significant. Thus, a multi-functional team with competent members to assess these affects is crucial [20]. A diverse committee also warrants top management involvement in obtaining approvals and improving the quality of data [14]. The literature survey identified one of the PSCs' key functions as FEL Management, in which the PSC is required to emphasize the importance of upfront planning and its positive effects on project success [20]. However, this study failed to establish any significant association between project success and the PSCs' involvement in the FEL phase of the project.

The survey results did not show any definite association between the PSC's ability to prioritize projects and project success. However, the study showed that 67% of overall respondents concurred with the statement that the PSC prioritizes projects based on the business need. This is an important trait required by the committee, as it ensures projects are aligned with the organization's objectives and business strategy [20].

The study ranked the PSC's openness to hearing "bad news" as the least important PSC function. In recent LCP failures, this attribute has been one of the major factors that affected the performance of LCPs, the Sasol Lake Charles project being a typical example. The failure of Sasol Lake Charles Project was most likely ascribed to the fear instilled in the organization that inhibited the communication of project risk [21].

The common competencies of a PSC were identified from the literature survey and listed in Table 8 above. The tabulated competencies are associated with technical expertise that members of the PSC are required to exhibit. The results suggest that the PSC's knowledge of Structured Corporate and Project Governance is of utmost importance. This corresponds with existing literature that considers PSC members as the custodians of project governance, ensuring it is deployed according to corporate governance standards [13]. Except for communication, the top five ranked competencies concur with the key competencies highlighted in the research by [15] in which he asserts that Decision Making, Stakeholder Management and Leadership are considered important skills for the PSC. According to [15] the PSC's ability to influence stakeholders and work across various stakeholder groups are two of the five skills PSC members need to enhance project performance. The survey relegated Communication Management as a core competency (ranking it 11th) while validating the importance of a PSC member's Negotiation Skills (ranking it 4th). This difference in ranking can be ascribed to the fact that Communication Management is a post-decision event. Whilst Negotiation Management is a pre-decision event that directly impacts project decisions [14].

Though PSCs' knowledge of Structured Corporate and Project Governance was ranked first, the study could not explicitly confirm the correlation between the PSC's understanding of policies and processes and project success. Highlighting, that whilst PSC members may understand their governing policies, it does not warrant project success and should not be considered in isolation from other competencies.

Significant variance was noted in the rating of competencies as specified in literature and the rating of competencies based on project practitioners' experience level. A similar trend was noted in the study by [20], who attributed this finding to either the project type, location of the project or the construct of the organizational PSC. The results further indicated that less experienced project practitioners consider interpersonal 'soft skills', such as decision making and practical field application, more important than risk management competencies. This may be ascribed to the fact that the more experienced project practitioners are well versed in managing their project functions and are aware of the PSCs' remit as compared to the less experienced practitioners.

Both [4] and [17] emphasized in their research the importance of information processing mechanisms to the PSC's ability to make well-informed and timely decisions. The survey results of this study also concurred with their findings. The results highlighted the importance of an organization having clearly defined criteria for reporting project status, and the escalation of risks to authority levels required beyond the PSC.

7. Conclusions and Recommendations

LCPs have a significant impact on today's local and international economies, representing the largest percentage of governmental expenditure [2]. Therefore, the success of these projects and the factors driving their success are significant. Research suggests that PSCs are an important factor in project success as they support coordination

between different structural units and are instrumental in implementing project management structures and policies [4].

In reference to the above, this study highlighted the function of a PSC within the current project environment. The top five functions of a PSC were identified as: custodianship of project governance, providing input to project development and evaluation strategy, providing steer on project budget, schedule, and quality, identifying and monitoring risks, provide effective and timely decision making on the project as it develops. The top five core competencies required of PSCs were identified as structured corporate and project governance, stakeholder management, project management, and decision making and negotiation skills. Although the survey showed that the PSC roles and responsibilities were defined at the project onset, there is a difference in appreciation of the functions of a PSC by the survey respondents with different project experiences. It is recommended to clarify and agree upon the PSCs functions early in the project life to ensure the improved management of expectations and eventual project success.

8. References

- [1] Mišić, S. & Radujković, M. 2015. Critical Drivers of Megaprojects Success and Failure. *Procedia Engineering*. vol. 122, no. Orsdc. pp. 71–80
- [2] Mcmanus, T. 2016. 'Managing big projects : The lessons of experience'. McKinsey Capital Projects & Infrastructure
- [3] Steyn, G., Burton, J. & Steenkamp, M. 2017. Eskom'S Financial Crisis and the Viability of Coal-Fired Power in South Africa - Implications for Kusile and the older coal-fired power stations
- [4] Lechler, T.G. & Cohen, M. 2009. Exploring the Role of Steering Committees in Realizing Value From Project Management. *Project Management Journal*. vol. 40, no. 1. pp. 42–54.
- [5] Weaver, P. 2007. Effective Project Governance - Linking PMI ' S Standards To. Corporate Governance
- [6] Locatelli, G., Mikic, M., Kovacevic, M., Brookes, N. & Ivanisevic, N. 2017. The Successful Delivery of Megaprojects: A Novel Research Method. *Project Management Journal*. vol. 48, no. 5. pp. 78–94.
- [7] Söderlund, J., Sankaran, S. & Biesenthal, C. 2017. The past and Present of Megaprojects. *Project Management Journal*. vol. 48, no. 6. pp. 5–16.
- [8] Nyarirangwe, M. & Babatunde, O.K. 2019. Megaproject complexity attributes and competences: Lessons from it and construction projects. *International Journal of Information Systems and Project Management*. vol. 7, no. 4. pp. 77–99.
- [9] Flyvbjerg, B. 2014. What you should know about megaprojects and why: An overview. *Project Management Journal*. vol. 45, no. 2. pp. 6–19.
- [10] Project Management Institute 2014. A Guide to the Project Management Body of Knowledge. PMI Publications (ed.), Emergency Department Leadership and Management: Best Principles and Practice. 5th edn. Project Management Institute, Inc, Pennsylvania 19073-3299.
- [11] Barshop, P. 2016. 'The Executive Role in Making Capital Projects Pay Off'. Independent Project Analysis, Inc.
- [12] Shirazi, S.S. 2007. Impact of steering committee configuration and decisions on project success in Pakistan. *Advances in Environmental Sciences, Development and Chemistry*. pp. 432–7.
- [13] Foundation, L. and J. 2018. Implementing a project : the role of a Steering Committee. Law and Justice Foundation. pp. 1–4.
- [14] Mosavi, A. 2014. Exploring the roles of portfolio steering committees in project portfolio governance. *International Journal of Project Management*. vol. 32, no. 3. pp. 388–99.
- [15] Perry, K. & Tankersley, J. 2014. In-Depth Report: Executive Sponsor Engagement— Top Driver of Project and Program Success.
- [16] Alias, Z., Zawawi, E.M.A., Yusof, K. & Aris, N.M. 2014. Determining Critical Success Factors of Project Management Practice: A Conceptual Framework. *Procedia - Social and Behavioral Sciences*. vol. 153. pp. 61–9.
- [17] Murphy, K. 2016. A Theory Of Steering Committee Capabilities For Implementing Large Scale Enterprise-Wide Information SYtsme. Case Western Reserve University pp. 30-45.
- [18] Easterby-Smith, M., Thorpe, R., Jackson, Paul, R. & Jaspersen, L.J. 2018. *Management & Business Research*. K. Smy (ed.),. 6th edn. SAGE Publications Ltd, london.
- [19] Saunders, M., Lewis, P. & Thornhill, A. 2009. Reserach methods for business students, 5th edn. ,Prentice Hall. pp. 450-457
- [20] Bekker, M.C. 2008. Project Governance for Capital Investments Philosophiae Doctor. Built Environment. University of Pretoria, South Africa.
- [21] Sguazzin, A. & Burkhardt, P. 2020. 'Shortcomings of leadership behind Sasol's fall from former glory'. BusinessLIVE.