AN INCLUSION OF VALUE LEAKS INTO EARNED VALUE ANALYSIS AS A MEASURE OF PROJECT PERFORMANCE

by

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An inclusion of value leaks into earned value analysis as a measure of project performance

I declare that the above thesis is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

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Mr EM Asiedu Date

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Father of the fatherless, is God in his holy habitation who promised never to leave me nor forsake me. I am so grateful for honouring thy word in my life.

(**Psalm 68:5; Hebrews 13:5b**).

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DEDICATION

This thesis is dedicated to my family, more especially, my wife Mrs. Portia Asiedu and my lovely children, Karen, Ernest and Marcia.

ABSTRACT

This study originally emanated from the debate on value creation through projects, which has become more prevalent in project management literature in recent times. Earned value analysis, which is widely used to measure and report the performance of project value, does not include the occurrence of value leaks in its calculations and reporting. Although there is a scarcity of literature on the issue of value leaks during project deployment, it is considered to be a big issue which can make or break a project's value success. This lack of research is more pronounced in network expansion projects in the Ghanaian telecommunication industry, however, considering the level of investment by these network operators, and their contribution to economic growth, the occurrence of value leaks can be suspected. Therefore, the overall aim of the study was to develop a diagnostic model that aids in the easy identification of value leaks, so that they can be controlled, and remedied to minimise the forgone unrealised project value.

In view of this, the study adopted an exploratory sequential mixed research design. The qualitative phase employed a multiple-case study approach to explore the concept of value leaks and the extent to which it becomes problematic in delivering overall project value. The quantitative phase, through a survey study, adopted factor analysis to test and validate the findings from the case study, and analyses were also performed to test the conceptual model fit to the retained dataset. The findings culminated in the development of the "Value Leaks-Flashlight", with an add-on called the "Tolerable Nut" to theorise the concept of value leaks. This practical establishment of the value leak concept cemented the development of the value leaks diagnostic model through the application of the "CIIR" acronym, which fulfils the overall aim of the study.

The study contributes to the contemporary literature in the field of project management, as the concept of project value leaks is still gaining prominence, and only a few empirical studies have thus far been conducted. The concept of value leaks enlightens the perspective of project management practitioners in their quest to achieve value through projects.

Key words: Project value leaks, telecommunication, earned value analysis, models, project management, network expansion projects, value creation, literature review, systematic review, conceptual framework.

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LIST OF ABBREVIATIONS AND ACRONYMS

The following abbreviations are used throughout the thesis:

AC	Actual cost
CFA	Confirmatory factor analysis
CO	Cost overrun
CV	Cost variance
EFA	Exploratory factor analysis
EV	Earned value
EVA	Earned value analysis
GNA	Ghana News Agency
KPIs	Key performance indicators
MNO	Mobile network operator
NCA	National Communication Authority
PE	Project environment
PL	Project life cycle
PMI	Project Management Institute
PQ	Poor quality
PS	Project Stakeholder
SEM	Structural equation modelling
SV	Schedule variance
TD	Team dissatisfaction
Telco	Telecommunication companies
TO	Time overrun
Towerco	Tower company
VL	Value leaks
UP	Out of scope

CHAPTER 1:
ORIENTATION AND OVERVIEW OF THE STUDY

1.1 INTRODUCTION

This chapter provides the background to and context of the study. This chapter focuses on the relevance of incorporating value leaks into earned value analysis (EVA) in measuring project performance, with particular reference to network expansion projects in the Ghanaian telecommunication industry. The discussion culminates in the development of the problem statement, research objectives, significance, assumptions, and limitations of the study.

1.2 CONCEPTUALISING VALUE LEAKS IN PROJECT MANAGEMENT

This section provides the background to the concept of value leaks as it is applied in the study that this thesis reports on, and also discusses the rationale of including it into EVA in the measurement of project performance. In view of this, this section presents an overview of value leaks in project management and the perspective of value leaks in the process of creating value through projects. This section also presents a discussion of the measuring of project performance, and the formulation of value leaks measures, as well as contextualising value leaks in network expansion projects in the Ghanaian telecommunication industry.

1.2.1 Overview of value leaks in project management

The concept of value leak during project implementation is a novel concept arising from the field of project management, and currently little work exists in the literature. The term ‘value leak’ is emphasised in the business case of a project discussed in a book titled *Making Technology Investments Profitable: ROI Road Map from Business Case to Value Realization,* by J.M. Keen (2011). In the context of a project business case, Keen (2011) explains the term ‘project value leaks’ as the forgone benefit that could have been fulfilled but that was lost due to project management slip-ups. However, it is noticeable that the expected values specified in the project business case are obtained from the outcomes of the project through value creation (Fuentes, Smyth & Davies, 2019; Mikkelsen & Marnewick, 2020; PMI, 2017).

Value itself is seen as the trade-off between benefits and sacrifices (Bertoni, Rondini & Pezzotta, 2017). Serra and Kunc (2015) added that value is interpreted as benefit realisation. While, in the business sense, the PMI (2017) asserted that value is the net quantifiable benefits gained from projects in the form of tangible elements (such as monetary assets, market share, and so forth) and intangible elements (such as brand recognition, reputation, and so forth).

The evidence suggests that value leaks in the form of overruns have become an integral part of day-to-day project management, irrespective of the industry (Hatsu, Mabeifam & Paitoo, 2016; Osei-Owusu & Henten, 2015; Al Zadjali, Bashir & Maqrashi, 2014). However, according to various authors, the occurrence of such overruns are more profound in the telecommunication, building and construction industries due to project magnitude, complexity, and the level of investments (Rodrigo *et al*., 2020; Hatsu *et al.*, 2016; Osei-Owusu & Henten, 2015; Al Zadjali *et al.*, 2014; Hasan, Suliman & Malki, 2014; Memon, Rahman, Abdullah & Aziz, 2014; Murray & Seif, 2013; Marzouk & El-Rasas, 2014; Sweis, 2013). This necessitates novel research into the area to uncover and develop diagnostic models that would help curb the occurrence of such leaks. The subsequent discussion provides more reasons and justification for the relevance of the study.

1.2.2 The perspective of value leaks in the process of creating value through projects

Discussions on the concept of value have been in existence since the ancient days (Ng & Smith, 2012). The reason is that business is set up to create value (Bowman & Ambrosini, 2000), and this value has always been related to commercial and monetary benefits to shareholders (Patanakul & Shenhar, 2007). Historically, the concept of value creation has been researched by authors from various different fields. For instance, Bowman and Ambrosini (2000) researched value creation versus value capture in the service sector and argued that the resources in the form of labour serve as a value creation source. They further added that a firm creates use value to grasp exchange value, which makes profit a real value for the business.

Similarly, Patanakul and Shenhar (2007) conducted research into programme value in the defence and aerospace industry. They argued that value created through programmes can be linked to three different stakeholders, namely, customer value, the performing organisation value, and the project team value. Patanakul and Shenhar (2007) further advocated that the concept of value must be incorporated into the formal processes of programme management. Although their studies on value creation are insightful, none of these traditional studies considered the possibility of value leaks in the process of creating value to satisfy shareholders.

Specifically in the field of project management, value creation through projects has in recent times attracted the interest of top scholars from across the world, such as Mikkelsen and Marnewick (2020), Zwikael, Chih and Restubog (2019), Riis, Hellström and Wikström (2019), Fuentes *et al.* (2019), Laursen (2018), Artto, Ahola and Vartiainen (2016), Laursen and Svejvig (2016), and Martinsuo and Killen (2014).

Whilst these scholars provide various perspectives on the way value creation is conceptualised and endorsed within the context of projects, none of them have focused on the value that leaks during project deployment, before the overall value is assessed at the completion of the project. For instance, a study by Zwikael *et al.* (2019) emphasised that organisations use projects as a value-creation instrument, and the creation of value for a client by solving a business problem should precede the service providers' quest for creating their own value, for example, in the form of attaining an improved reputation. From Zwikael *et al.*'s (2019) study, it is noticeable that the value of solving a business problem, while simultaneously attaining an improved reputation, can be seen as the aftermath of the value-creation process.

Also, Riis *et al.* (2019) considered how value is effectively created by a permanent organisation through temporary projects, and Liu *et al.* (2019) advocated that stakeholders should pay attention to value co-creation at the front-end of infrastructure programmes. Although it can be contended that the expected value created through the project becomes evident at the end of the project, the question arises concerning the part of the value that does not see the light of day. In support of this assertion, Fuentes *et al.* (2019) asserted that the outcomes of project value become conspicuous in the final phase of the project, although such outcomes are connected to the project's definition phase. Similarly, the Project Management Institute (PMI) (PMI, 2017) stressed that projects are a vital mode of creating value and benefits for organisations, and this business value in projects is the outcome that is derived to benefit its stakeholders. Furthermore, Mikkelsen and Marnewick (2020) offered an interesting perspective that the concept of benefit realisation and value creation address the same objective of converting project output into a positive outcome for the owners of the project.

Therefore, this background solidifies the study and justifies the need to speculate beyond the current thinking on value creation or benefit realisation in the form of project outcomes, by exploring the value leaked during project deployment, which is the value that is not realised as part of the project's outcomes and is considered as business value. The next section discusses how value leak becomes evident in measuring project performance.

1.2.3 Measuring project performance and formulation of value leaks measures

The ancient debate on what constitutes successful project implementation is still ongoing (Davies, 2014; Howsawi, Eager & Bagia, 2011; Ika, 2009; Meredith & Mantel, 2006; Baccarini & Collins, 2003; Cooke-Davies, 2002; Atkinson, 1999; Lui & Walker, 1998; Belassi & Tukel, 1996; Cooke-Davies, 1990; Pinto & Slevin, 1988). As previously discussed, recent authors have, however, changed the narrative in the debate to place the emphasis on value when assessing project success (Mikkelsen & Marnewick, 2020; Zwikael *et al.*, 2019; Riis *et al.*, 2019; Fuentes *et al.*, 2019). This change in focus has brought about a shift from product creation to value creation (Winter & Szczepanek, 2008). This focus on value creation is considered as an alternative to the traditional emphasis on product creation (Green & Sergeeva, 2019). Albeit, Green and Sergeeva (2019) further contended that this sudden focus on value creation emanated from the never-ending debate on deciding on project success.

Keen (2011) opined that keeping programmes on-value is a key management challenge because value leak can be regarded as an unrealised benefit opportunity resulting from mismanagement. In view of this, PMI (2017) asserted that poorly managed projects lead to missed deadlines, cost overruns, poor quality and rework, as well as the uncontrolled expansion of the project. In addition, Pennypacker (2005), director of the Center for Business Practices (CBP) and PM Solutions, asserted that there is no single uniform set of measures that are commonly used to measure project performance across industries.

The lack of standardisation suggests that industries apply different measures of performance to track the success (or otherwise) of their operations. Therefore, the current study conceptualised the common value measures of project performance, as asserted by some influential authors, to formulate the value leaks measures which would give an indication of its occurrence during project deployment, as exhibited in Figure 1.1.

Figure 1.1 illustrates that traditionally, the triple constraints theory is considered to be a standard measure of project success, irrespective of the industry (Baccarini, 1999; Pinto & Mantel, 1990). In support of this argument, Mantel, Meredith, Shafer and Sutton (2011) contended that project performance is measured by the following three criteria: (1) the project is on time or ahead of time, (2) on or under budget, and (3) it delivered the agreed upon outputs to meet the customer’s requirements. Thus, the project is on time, on budget and within scope.

Agarwal and Rathod’s (2006) findings concur with those of the aforementioned authors, however, they added project priorities and customer satisfaction to cost, time, and scope, as the key metrics to measure performance. Atkinson (1999) contended that project success should be assessed beyond the triple constraints of time, cost and quality. This assertion by Atkinson lays the foundation for redefining how projects should be assessed with the emphasis on value creation.

In an earlier study, Baker and Murphy (1974) outlined that project success is achieved on the basis of time, cost, performance, satisfaction of project team and client. Similarly, a study by Wang and Huang (2006) identified quality, project team satisfaction and relationship as key metrics to add to cost and time. Smith (2007) also included performance and client acceptance as relevant to measuring the performance of a project. For their part, PMI (2017) added quality, resources and risk to the already identified cost, time, and scope in the metrics that ensure efficient measurement of project performance.

This endorses that traditional thinking on projects has moved towards creating strategic value from projects (Green & Sergeeva, 2019). Nevertheless, Kelly (2007) argued that the concept of value has not been developed in value management texts beyond the triple constraints, as the value that businesses gain from projects is a quantifiable aftermath of the value-creation process in the form of tangible elements (monetary assets, market share) and intangible elements (brand recognition, reputation) (PMI, 2017). This assertion related to business value by PMI (2017) is a clear indication of measuring the value aftermath of project implementation.

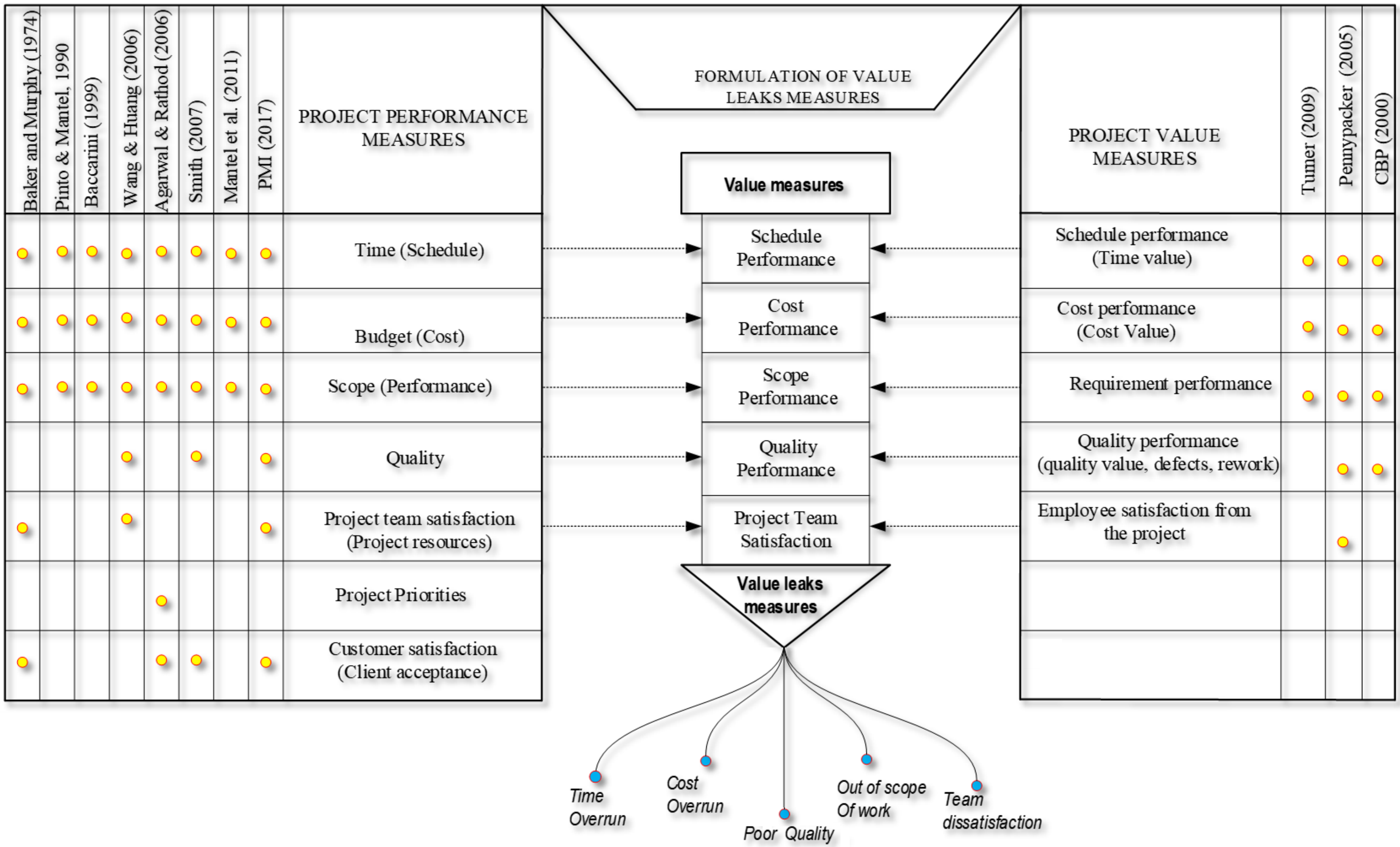

Figure 1.1: Formulation of value leaks measures

Source: Author's own compilation (2019)

Nonetheless, in measuring value as demonstrated in Figure 1.1, the CBP (2000) asserted that the value metrics used to measure the project value include:

- **time**: on time delivery against commitment,
- **cost**: the total value cost
- **quality**: the delivery of quality against specifications and cost of rework; and
- **scope**: delivery within scope.

In support of this, Turner (2009) added that the benefit of a project is linked to the time value, cost value and quality value, which must be managed to realise the desired benefits. The expected values being created through projects can be measured during and after or post- implementation of the projects. In view of this, Pennypacker (2005) proposed 10 measures every company, regardless of the industry, could benchmark to achieve project management success. The notable measures used during project deployment are cost of quality, cost of performance, schedule performance, requirement performance, and employee satisfaction.

Figure 1.1 further shows that the common value measures deduced to measure the value during project implementation are: schedule performance (on time), cost performance (on cost), scope performance (within scope of work), quality performance (within quality metrics) and project team satisfaction. However, the part of value that does not see the light of day becomes evident when there is an inverse of these value measures as formulated, since project management literature lacks sufficient works from that perspective. Noticeably, no research work has considered the occurrence of these measures, namely, overruns, poor quality, out of scope and team dissatisfaction during project deployment as value leaks measures.

Therefore, within the context of this study, value leak was assessed with an occurrence of time overrun, cost overrun, poor quality necessitating rework, out of scope activities and project team dissatisfaction, as formulated in Figure 1.1. These value leaks measures are briefly explained as follows:

- Firstly, when a project is delayed, it is termed as *time overrun* (Bentil, Nana-Addy, Asare & Fokuo-Kusi, 2010; Ismail, 2014; Pai & Bharath, 2013; Ameh, Soyingbe & Odusami, 2010).

- Secondly, when a project goes beyond its original budget, it is considered as *cost overrun* (Rauzana, 2016; Ismail, 2014; Love, Wang, Sing & Tiong, 2013; Memon *et al.*, 2014).
- Thirdly, when a project does not meet the predetermined quality standards, it is termed as *poor quality* (Newton, 2015; Vrincut, 2014; Verzuh, 2004).
- Fourthly, when there are unbudgeted scope activities, it is considered as out of scope (PMI, 2017; Desmond, 2004; Smith, 2007).
- Fifthly, when a project team is demoralised and becomes unproductive it is termed *team dissatisfaction* (PMI, 2017).

The causal factors of these value leaks measures and their possible sources of origin are discussed below.

1.2.4 Measures of value leaks' causal factors and their sources of origin

In view of the measures of value leaks formulated in Figure 1.1, there have been several research works from different countries and across different industries that have investigated the causal factors for time and cost overruns. However, few works are available on poor quality, out of scope and team dissatisfaction. Regardless of the research focus, none of the available scholarly works considered their identified causal factors to be the factors that cause project value leaks during deployment.

Bentil *et al.* (2017) are counted among the authors of these scholarly works, and they conducted research into the level of occurrence and impact of cost and time overruns of construction projects in Ghana. They found factors such as gold plating or over-specification, late delivery of materials, inaccurate time and cost estimates, and labour disputes to be some of the causal factors for the overruns (in terms of time and cost).

Rauzana's (2016) study on the failure of construction projects in Indonesia found high inflation and interest rates, changes in project scope, poor client-vendor relationship, conflict among project participants, poor supervision and inspections to be some of the overruns' causal factors.

A study by Taherdoost and Keshavarzsaleh (2016), similarly, outlined the factors that cause project team dissatisfaction. These factors include changes in organisational management and leadership, the negative effects of corporate politics, an unsupportive organisational culture, different geographical locations, lack of top management support, poor client-vendor relationship, and an unstable organisational environment.

Murray and Seif's (2013) research identified poor communication, poor site management and supervision, inaccurate time and cost estimates, as among some of the factors causing overruns in Nigeria's construction industry. Alinaitwe, Apolot and Tindiwensi (2013) found factors which include, among others, the late delivery of materials, inexperienced contractors, and ill-defined project scope as overruns' causal factors in the construction industry in Uganda.

A research study by Al Zadjali *et al.* (2014) into the causal factors for overruns in a telecommunication project in Oman, found factors such as inaccurate time and cost estimates, indecisiveness of project participants, lack of top management support, and poor cost estimates. Also, Danso and Antwi (2012) from Ghana investigated tower projects executed by Tigo (one of the five mobile network operators in Ghana) between 1992 and 2011. They found that the factors that cause time and cost overruns include poor site management and supervision, poor contract management, poor deliverable quality, incorrect requirements, lack of understanding of end-user requirements, delays in payment, and so forth.

Jha and Iyer (2006) investigated the reasons for the underperformance of the quality of Indian construction projects, and their research found out that factors, such as conflict among project participants, hostile socio-economic and climatic conditions, project manager's ignorance and lack of knowledge, and faulty project conceptualisation, cause poor project quality. In addition, factors such as poor scoping, and incomplete and errors in project requirements, among others, are found to cause a project to go out of scope within the construction industry (Ade-Ojo & Babablola, 2013).

The scholarly works mentioned above point mainly to the building and construction industry as the predominant sector. Noticeably, there has not been any study that integrates all the formulated measures within the context of value leaks to assess project performance quantitatively.

In line with the sources of value leaks' causal factors, projects do not exist in a vacuum but rather within an environment. Simushi (2017) asserted that the project environment encompasses several factors and influences that can directly or indirectly impact the outcome of the project. Simushi (2017) further added that this project environment entails the financial and economic conditions, governmental and regulatory agencies, labour unions, equipment vendors, contractors and sub-contractors, and so on.

In view of this, Ludovico and Petrarca (2010) affirmed that these factors can improve or impact the outcome of projects negatively or positively. With respect to an assertion by Simushi (2017) on what constitutes project environment, it can therefore be contended that the aforementioned factors, such as high inflation and interest rates, the negative effects of corporate politics, an unsupportive organisational culture, different geographical locations, conflict among project participants, and hostile socio-economic and climatic conditions (Bentil *et al.*, 2017; Rauzana, 2016; Taherdoost & Keshavarzsaleh, 2016; Jha & Iyer, 2006), are all related to project environment.

This arguably causes project environment to be a source of value leaks during project deployment. Although, from the discussed literature, there is some evidence of research work on the project environment, however, no research work is seen to have situated the concept value leaks within project environment as a source of its occurrence, and determined the impact of this project environment on project performance. In addition, AlSehaimi, Koskela and Tzortzopoulos (2013) opined that project overruns appear to have emanated from the actions and the inactions of the project team executing the project. Similarly, the outcomes of the projects are influenced by project stakeholders (PMI, 2017), as the power and interest of these project stakeholders ultimately determine whether a project will succeed or not (PMI, 2013).

Therefore, the project stakeholder is conceptually considered to be a source of value leaks and the causal factors outlined above, noticeably relating to the project stakeholders include poor client-vendor relationships, conflict among project participants, and poor communication (Rauzana, 2016; Murray & Seif, 2013; Danso & Antwi, 2012). Conspicuously, little or no scholarly work has considered project stakeholders as a source of value leaks, and has attempted to establish quantitatively, the impact of the project stakeholder on project performance.

Finally, every project goes through a series of phases known as the project life cycle before delivering the project outcome (PMI, 2017; Turner, 2009). Turner (2009) describes project life cycle as the process of turning organisational vision into reality, from ideation to closure. From the literature, overruns' causal factors, such as inaccurate time and cost estimates; incomplete and errors in project requirement/specifications, improper planning and scheduling, and poor scoping are considered to be happening during the planning phase of the project life cycle (Ade-Ojo & Bablabola, 2013; Murray & Seif, 2013; Danso & Antwi, 2012).

It can, therefore, be contended that the project life cycle is a source of value leaks, as in the quest to turn the project objective into reality, some factors may influence the process. Noticeably, no study has either situated the project life cycle as a source of value leaks or determined the quantitative impact of the project life cycle on project performance. The techniques used to determine the occurrence of these value leaks measures are presented in the section below.

1.2.5 Techniques to monitor project performance

With reference to the project value and value leak measures formulated in Figure 1.1, noticeably, there are some techniques that are used to monitor the performances during project deployment. Table 1.1 (on the next page) provides a summary of the various project techniques to control project value measures, namely, project budget performance, project schedule performance, project scope performance, project quality performance, and project team satisfaction, which are subsequently discussed in more detail.

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Table 1.1: Synopsis of project techniques to control project value measures

References	Value measures	Control techniques	Control techniques	Observations
PMI (2017)	Project budget performance	Variance Analysis	Cost Variance (CV) and Cost Performance Index (CPI) assess budget overrun or underrun	CV and SPI are all metrics of Earned Value Analysis
		Forecasting	Estimate To Complete (ETC) makes projections of actual amount needed to complete the available project activities	ETC is a metric of EVA
PMI (2013)	Project schedule performance	Schedule Compression	Earned Value Analysis does not assess project team satisfaction	EVA gives indication about schedule compression
		Variance Analysis	Schedule Variance (SV) and Schedule Performance Index (SPI) assess degree of variation to the original schedule baselines	SV and SPI are all metrics of EVA
Olaf (2009)	Project scope performance	Earned Value Analysis	Calculating the key values for each activity. Budgeted cost of work scheduled (BCWS), actual cost of work performed (ACWP), Budgeted cost of work performed (BCWP).	All metrics of EVA are employed
		Variance	SV and CV determine the cause and degree of difference between the baseline and actual performance.	SV and CV are all metrics of EVA
Dinsmore & Cabanis-Brewin (2011)	Project quality performance	Quality Audits	Determine whether quality-related work and the results obtained from work conform to the standards and planned requirements	EVA does not measure quality
		A cause and effect diagram (Fishbone diagram)	This tool is used to show how various factors are linked to identified problems or adverse effects	
Mantel *et al.* (2011)	Project team satisfaction	Project Performance Appraisals	Appraising project team and provide constructive feedback to team members with reward and recognition	EVA does not assess project team satisfaction
		Conflict Management	Resolving and managing differences in the project teams to increase productivity and enhance working relationships	

Source: Researcher's own compilation (2019)

As shown in Table 1.1, the variance analysis technique is carried out to determine project budget, schedule and scope performances (PMI, 2017). The variance analysis metrics include Cost Variance (CV), Cost Performance Index (CPI), Schedule Variance (SV), and Schedule Performance Index (SPI). In line with project budget performance, CV and CPI metrics are used to assess the deviation in project budget performance in terms of cost overrun and cost underrun (PMI, 2013). In addition, the forecasting technique, Estimate to Complete (ETC) is used to make projections of the actual amount needed to complete the available activities (PMI, 2017; Pennypacker, 2005).

Project schedule performance uses Schedule Variance (SV) and Schedule Performance Index (SPI) to assess the degree of variation to original schedule baselines in the form of time overrun or ahead of time (time underrun). Similarly, the Schedule Compression is used to bring delayed project activities back on track. This technique is only useful when the delay has been identified by other techniques. Both SV and CV are used to determine the cause and degree of differences between the baseline and actual performance of the project scope (Olaf, 2009; PMI, 2013). Essentially, the variance analysis metrics (CV, CPI, SV, SPI), as well as forecasting (ETC) all form part of the EVA technique, as shown in Table 1.1.

Table 1.1 above, also demonstrates how quality audits and cause-and-effect techniques are used to measure project quality performance. The Quality Audit technique determines whether quality-related works and the results obtained from them conform to the standards and planned requirements (Dinsmore & Cabanis-Brewin, 2011). Cause-and-effect diagrams (for example, the Ishikawa diagram or fishbone diagram) also show how various factors are linked to identified problems or adverse effects (Dinsmore & Cabanis-Brewin, 2011).

The techniques used to measure project team satisfaction/dissatisfaction are Project Performance Appraisals and Conflict Management (Mantel *et al.*, 2011). The former ensures the appraisal of project teams, while providing constructive feedback to team members in the form of rewards and recognition. The latter, however, ensures that differences in project teams are managed and resolved in order to increase productivity and enhance working relationships (Mantel *et al.*, 2011).

Therefore, from the above discussion, EVA is considered as the most powerful technique as well as a unit of standard measure for project progress, since it integrates cost, schedule and scope to judge project performance and progress (Dayal, 2008; Mehedintu *et al.*, 2008; Rajhans *et al.*, 2016; PMI, 2013, Noori, Bagherpour & Zareei, 2008, Lukas, 2008; Freeman & Beale, 1992).

Although the application of EVA has been adopted worldwide by many organisations as a standard measurement tool (DOD, 1997) as its principles can be applied to all projects in any industry (PMI, 2013), EVA does not measure project quality performance and project team satisfaction, which are viewed as important parameters in assessing project performance. Also, it does not take into cognisance value leaks in its calculations for reporting project performance, hence, the need for this study.

1.2.6 Earned value analysis (EVA) as a technique to measure project performance

Earned value analysis (EVA) is a statistical calculation performed to compare the project performance measurement baseline to the actual delivery time and budget performance (PMI, 2013, 2017; Mantel *et al.*, 2011). It is noticeable from Table 1.1, that EVA is the only technique that integrates project time (schedule), cost (budget), and scope (requirements) to measure project performance. The application of EVA ensures an efficient evaluation of project performance; that is, it determines whether a project is being delivered on time, behind time or ahead of time, as well as on planned budget, over budget or below budget.

To be able to determine project performance, the following key variables of EVA must be understood:

- **Planned Value (PV):** the approved budget located for a planned work of the project and it is commonly called budget at completion (BAC). PV is the physical work expected to be performed, and its budget is based on phase allocation throughout the project life cycle.
- **Actual Cost (AC):** the cost incurred to complete work activity within a specific time. It is also the overall amount spent on the work with which EV is determined.
- **Earned Value (EV):** looks at the total planned value of the accomplished work and it is expressed in terms of the approved budget for that completed work. Lukas (2008) explained that EV is determined by multiplying an activity budget by its

progress percentage. Thus; EV = % complete x budget. It is worth noting that the work activities within the narratives represent the scope of work approved to be performed in order to achieve the project objectives.

1.2.6.1 Situating value leaks in earned value analysis

In considering Keen's explanation of value leaks (Section 1.2.1), it is considered to be an unrealised benefit opportunity resulting from mismanagement (Keen, 2011). The impacts of this mismanagement lead to missed deadlines, cost overruns, poor quality and rework, as well as uncontrolled expansion of the project (PMI, 2017). These impacts form part of the measures derived for assessing the occurrence of value leaks (see Figure 1.1). However, EVA is established as the technique to measure project performance based on time, cost, and scope (see Table 1.2), although, it does not measure project quality performance and project team satisfaction.

Nonetheless, Figure 1.2 (on the next page) demonstrates how value leak could be situated within the context of EVA, although on the account of assessing project performance, it does not take cognisance of its occurrence. With respect to value leaks within EVA, as exhibited in Figure 1.2, PMI (2017), asserted that the application of EVA to assess project performance is determined by four (4) variance metrics, as listed below:

Firstly, **Schedule variance (SV)** which shows whether the project is ahead, on, or behind the planned delivery date at any given point in time. From Figure 1.2, SV is therefore determined by the difference between earned value (EV) and planned value (PV). Thus; SV = EV-PV. The results offer three (3) scenarios: first, the project is behind schedule when SV is negative (termed as time overrun). Second, it is on schedule when SV is zero (termed as on time delivery), and it is ahead of schedule when SV is positive (ahead of delivery time). However, when SV is negative then there is an occurrence of time overrun which can be considered as a value leak, based on Figure 1.1.

Secondly, **Cost variance (CV)** which indicates whether the project's budget has been overspent (cost overrun/ deficit) or under spent (surplus) at a given point in time. CV is determined by the difference between earned value (EV) and actual cost (AC); CV= EV – AC as illustrated in Figure 1.2. However, when a budget for work activity is overspent (cost overrun), CV becomes negative, resulting in value leaks. This arguably, means that additional budget is required to complete project activities. However, when CV is positive, AC means cost is underrun.

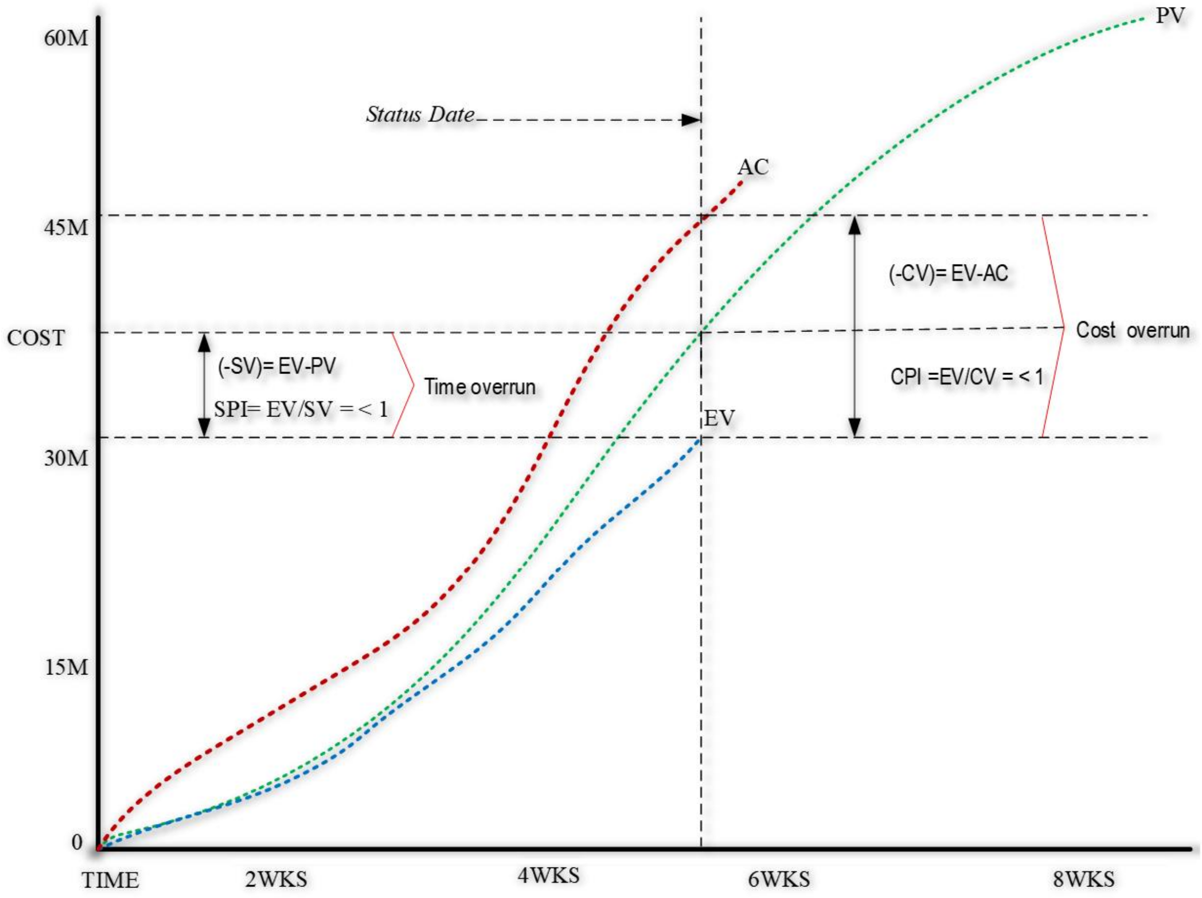


Figure 1.2: Situating value leaks in earned value analysis

Source: Adapted from PMBOK® Guide, 2008

Thirdly, **Schedule Performance Index (SPI),** which shows how effectively time is used by the project team. From Figure 1.2, SPI = EV/SV, but when SPI value is less than 1.0, it means less work (scope of work) is done than was expected (time overrun). Debatably, the project team is being ineffective on the timeliness of project activities, which results in value leaks on the basis of the occurrence of time overrun. However, a SPI value of more than 1.0 means more work has been completed than planned (time underrun).

Finally, **Cost Performance Index (CPI)** which indicates how efficiently budget is utilised for the completed work (scope of work) and is considered to be the most important metric and measure of EVA. As shown in Figure 1.2, CPI =EV/CV, and when the CPI value is below 1.0, it shows a cost overrun for the accomplished work.

Arguably, this inefficiency in budget utilisation results in value leaks. Nevertheless, when the CPI value is above 1.0, it indicates cost underrun of work done.

Interestingly, while there have been several research studies and publications on EVA, as presented in Table 1.2 (a gap analysis on EVA), none of these publications considered the concept of value leaks in the quest to expand EVA.

As seen in Table 1.2, Lipke (2013) found that Schedule Adherence, an extension of EVA, provides early warnings to project managers when projects are not completed within schedule. If not, completion times tend to be elongated causing an increase in project costs. However, Lipke (2013) failed to discuss elongated time and increase in cost in the context of value leaks.

Furthermore, Crumrine (2013) experimented with earned schedule (ES) developed by Lipke (2003) as an extension to EVA in Airforce Defence Acquisition programmes. The author found that ES predictions were more accurate compared to EVA, although the concept of value leaks was excluded from the study.

Similarly, studies by Davis (2009), Corovic (2007) and Lipke (2005) did not consider value leaks in their effort to expand EVA, as demonstrated in Table 1.2 (on the next page).

Table 1.2: Gap analysis on Earned Value Analysis (EVA)

References	Titles	Limitations of EVA	Research aim	Concept findings	Critics
Lipke (2013)	Schedule Adherence: A Useful Measure for Project Management	Project completion which is not in accordance with the planned schedule normally has adverse consequences; cost increases (Cost overrun) and duration is elongated (Time Overrun)	This paper employs the new practice of Earned Schedule to discuss a proposed measure for further enhancing the presence of EVA	Schedule Adherence was seen to provide extra early warning signs to project managers, leading to an improved decision making	Value leaks concept is not identified
Crumrine (2013)	Earned Schedule: Utility in Major U.S. Air Force Acquisition Programmes	EVA measures schedule on the basis of dollars, instead of time, and is apparently useless over the final third of a project	To explore the application of Earned Schedule (ES) to Airforce defence acquisition programmes	ES offers more accurate schedule predictions than EVA	Value leaks concept is not identified
Davies (2009)	Earned Schedule: Principles and Practice	EVA does not provide management guidance for project control and schedule control	The idea is to determine the time at which the EV accrued should have occurred	Project managers have a schedule analysis tool that improves the confidence in forecasting delivery dates	Value leaks concept is not considered
Corovic (2007)	Planning, Optimizing and EVM	SPI is defective over the final third of a project's life cycle	Researchers are unanimous that the conventional EVA is a very good tool to calculate project cost performance	Earned Schedule (ES) express schedule delay in time units	Value leaks concept is not considered
Lipke (2006)	Earned Schedule: an extension to EVM	The completion of work activities leads to earning project budget, irrespective of how late the project gets completed	Evaluating project performance using EVM	Earned Schedule resolves schedule indicators flaw	Value leaks concept is not identified

Source: Researcher's own compilation (2019)

1.3 CONTEXTUALISING VALUE LEAK IN NETWORK EXPANSION PROJECTS IN THE GHANAIAN TELECOMMUNICATION INDUSTRY

The above discussion on value leaks formed the basis for situating the concept of value leaks during network expansion projects in the Ghanaian telecommunication industry. The reason is that there is a scarcity of research works that focused on network expansion projects, especially within the telecommunication industry in Ghana. Considering the level of investments made through network expansion projects by Ghanaian network operators and their contributions to economic growth in recent times, the possibility of the occurrence of value leaks increases. Keen (2011) emphasised that value leaks are considered big issues in project management, and the ability to control or avert them can make or break a project's value success.

The telecommunication industry is one of the most dynamic industries in the world, and due to its rapid growth, the companies within this industry are forced to continuously undertake projects on network expansions, among others, to satisfy the market and customer needs (Al Zadjali *et al.*, 2014). According to Sherif (2006), a network expansion project is undertaken in response to regulatory directives or customer demands.

In assessing project success in the telecommunication sector, Desmond (2004) indicated that for a project to be considered as a success in the telecommunication sector, it must be completed on time, be completed within budget, and meet the defined project scope goals. These project success criteria in the telecommunication sector confirm the triple constraints theory assertion, that it is the traditional standard measure of project success, irrespective of the industry (Baccarini, 1999; Pinto & Mantel, 1990). Among the techniques that are used to monitor project performance, EVA is considered to be a technique that integrates project time (schedule), cost (budget), and scope (requirements) to measure project performance.

Therefore, keeping all of the above in mind, in combination with the fact that there is little or no research to unravel value leaks in this sector, there is adequate justification for the selection of network expansion projects in the telecommunication sector in Ghana for the current study. It is worth noting that the term 'network expansion project' is used interchangeably with 'site projects' within the telecommunication industry, which was similarly adopted for the purpose of this study. The subsequent sections discuss the investments made through network expansion projects, their contributions to economic growth in Ghana and the research gaps.

1.3.1 Network expansion projects' investments in the Ghanaian telecommunication industry

The level of investments in network expansion projects by network operators in Ghana in recent times cannot be overemphasised, as shown in Table 1.3 (on the next page). According to the Ghana News Agency (GNA, 2015), MTN, the market leader in the telecommunication industry in Ghana, spent US$2.4 billion on network expansion from 2006 to 2014. Also, in 2015, MTN made more enhancements to their service capacity by investing an additional US$103 million on network improvement and expansion.

Vodafone, ranking second to MTN in terms of market share, spent US$1.7 billion on network expansion from 2007 to 2014, and US$700 million in 2015 to upgrade their network infrastructure.

Tigo, the third largest mobile operator in Ghana, spent up to US$24 million on network expansion from 2007 to 2014, adding 114 new cell sites to its existing ones. The fourth largest network, Airtel, spent GH₵200 million on a Ghanaian nationwide network expansion in this same period. However, currently, Tigo and Airtel have merged as AirtelTigo.

Presently, mobile operators have continued to make significant investments in the expansion of their network infrastructure, for example, MTN spent up to US$143.7 million in 2017 alone. In effect, MTN has 197 new 4G sites, adding to its current 475 sites, while their 3G services have also been boosted with an additional 561 sites.

While the Ghanaian telecommunication industry has seen significant investments from its top mobile operators, little has been done to ascertain the unrealised value (value leaks) that might be associated with these investments, the factors that cause it and the sources of these causal factors.

Table 1.3: Summary of network expansion projects in the Ghanaian telecommunication industry

Sources	Mobile operator	Project cost	Project type	Objective
GNA (2017)	MTN	$143.7 million in 2017	Network expansion	Expand, upgrade and maintain MTN state-of-the art (Add 197 new 4G sites to existing 475 sites/561 new 3G sites) network infrastructure.
GNA (2017)	MTN	$103 million in 2015	Network expansion	Network improvement and expansion
Laary (2015)	Airtel	GH₵ 200 million in 2015	Network expansion	Nationwide network expansion
Myjoyonline.com (2015)	Vodafone	$700 million in 2015	Network expansion	Upgrading of network infrastructure
Laary (2015)	Tigo	$24 million in 2015	Network expansion	Boost network quality and capacity in three regions (114 cell sites)
GNA (2015)	Vodafone	$1.7 billion from 2007-2014	Network expansion	Strengthen the operations of the network in the past seven years
GNA (2015)	MTN	$2.4 million from 2006-2014	Network expansion	Increase network capacity, improved data speeds, reduction in overall network congestion.

Source: Researchers' own compilation (2019)

1.3.2 Contribution of network expansion projects to economic growth in Ghana

These network expansion projects are highly capital intensive (Ameh *et al*., 2010) and their outcomes contribute immensely to national investment and economic growth in developing economies (Ofori, 2013; Sweis *et al.*, 2013). In Ghana, as a developing economy, three mobile operators have spent over US$1.170 trillion on network expansion projects between 2015 and 2017, as shown in Table 1.3, and these mobile operators pay a yearly tax of US$650 million constituting 40% of total revenue in the sector (GCT, 2019).

In the industry as a whole, the total taxes paid by the industry in 2013 amounted to GH₵1.04 billion, and in 2014, it spiked to GH₵1.05 billion. These tax amounts formed 6.9% and 5.4% of the Ghanaian government's tax revenues for 2013 and 2014, respectively. It is clear that the industry is a major contributor to economic growth constituting 24.7% out of 49.5% of the total service sector's contribution to GDP (Gross Domestic Product) in 2013. In 2010, it contributed 7% to national investment, 10% of government income, and 1.9% of total GDP, while in 2013, its GDP contribution rose to 2.4% (Ghana Statistical Service, 2014).

The telecommunication industry directly employs more than 5 000 people, while indirectly it employs more than 1.5 million people involved in serving and promoting other industries such as banking, media, advertising, agriculture, health, education and construction (GCT, 2019). However, observably little or no research has been done within this sector to appreciate the magnitude of value leaks that might have occurred, and situate it as a financial loss to the companies and their contributions to economic growth, in order to improve value delivery through these projects.

1.3.3 Preview of research into network expansion projects in the Ghanaian telecommunication industry

The critical issue, as far as project management is concerned, has been the rising occurrences of value leaks, as discussed earlier, in the form of time overruns, cost overruns, not meeting scope of work, poor project quality (rework), and project team dissatisfaction (PMI, 2017; Mantel *et al.*, 2011; Smith, 2007; Pennypacker, 2005; CBP, 2000). A significant amount of research work has been done on time and cost overruns (a facet of value leaks) in other sectors, such as construction and real estate in Bahrain (Hasan *et al.*, 2014), in Malaysia (Memon *et al.*, 2014), in Nigeria (Murray & Seif, 2013), in Egypt (Marzouk & El-Rasas, 2014) and in Jordan (Sweis, 2013). However, there exists little or no research on the concept of value leaks occurrence in the telecommunication industry in Ghana, as well as globally.

As shown in Table 1.4, the only known research was conducted by Danso and Antwi (2012), which considered the factors of time and cost overruns in telecommunication tower construction in Ghana. Their research focused solely on tower construction, and barely explored the multi-faceted aspects of network expansion projects in the telecommunication industry (Sherif, 2006).

Table 1.4 provides a summary of previous research in network expansion projects in the Ghanaian telecommunication industry.

Table 1.4: **Snapshot of previous research in network expansion projects in the Ghanaian telecommunication industry**

References	Titles	Approach	Purpose	Inferences	Gaps
Edwards (2020)	Demand forecasts for telecom infrastructure equipment and services in Sub-Saharan Africa	Market Research (Qualitative)	Why Towercos and MNOs have to maintain network availability and boost capacity.	Countries such as Ghana, MNOs and towercos require significant investments in cell sites, sites upgrade and turnkey infrastructure services	No focus on value leaks concept
Song (2020)	Africa Telecoms Infrastructure in 2019	Articles Review	Review of over 270 articles covering range of African telecom infrastructure development issues in 2019.	In Ghana, there is a debate on which MNO to acquire the remaining 800MHz spectrum after MTN acquired 20MHz and Vodafone 10MHz.	No focus on value leaks concept
GSMA (2019)	The Mobile Economy West Africa	Market Research (Qualitative)	3G takes the lead, but 4G momentum is building	In Ghana, Huawei is collaborating with the government and MTN to address the rural connectivity challenge through lightweight rural network coverage solution supporting 2G, 3G and 4G connectivity	No focus on value leaks concept
Chichester *et al.* (2017)	Women's Economic Empowerment in Sub-Saharan Africa: Recommendations for the Mobile Telecommunications Sector	Mixed Method Approach	This brief provides recommendations for mobile telecommunications companies on how to advance women's economic empowerment in sub-Saharan Africa, focused on three key countries: Ghana, Kenya, and Tanzania.	Limited access to mobile telecommunications services for women in rural areas: Although the cost of phones has gone down, the lack of infrastructure, particularly in rural areas, affects women's access to mobile telecommunications services.	No focus on value leaks concept
Danso & Antwi (2012)	Evaluation of the Factors Influencing Time and Cost Overruns in Telecom Tower Construction in Ghana	Cross-Sectional Survey (Qualitative)	Evaluate the factors influencing time and cost overruns of the telecom tower construction projects in Ghana	Tigo Ghana tower construction projects executed between 1992 and 2011 experienced as much as 82% time overruns and the cost of the projects increased by 50%.	Facet of value leak concept is focused but insufficiently discussed.

Source: Researchers' own compilation (2019)

The focus on time and cost overruns in network expansion tends to be an inadequate measure of efficiency, as it ignores other important value metrics as illustrated in Figure 1.1. Some of these include the inability to meet project requirements (out of scope), poor project quality (or rework) and project team dissatisfaction (Wang & Huang, 2006; Verzuh, 2004; CBP, 2005, 2000). Besides, Danso and Antwi (2012) only interviewed Helios Towers, which is one out of the three mandated tower companies in Ghana, and Tigo Ghana, the third-largest operator in the telecommunication industry in Ghana. Albeit, their findings do not show a holistic reflection of the value leaks occurrence in the telecommunication industry in Ghana. Conversely, their study revealed that 35% to 55% of the Tigo Ghana projects implemented from 1992 to 2011 experienced as much as 82% of time overruns and the cost of the projects increased by 50%.

Edwards (2020) research into demands forecasts for telecom infrastructure equipment and services in Sub-Saharan Africa revealed countries such as Ghana, mobile network operators (MNOs) and tower companies (towercos) require significant investments in cell sites deployment, sites upgrades and turnkey infrastructure services in order to maintain network availability and boost capacity, although their study ignored the concept of value leaks.

Song (2020) reviewed Africa telecoms infrastructure in 2019. Although, their findings revealed that in Ghana, there is a debate on which MNO to acquire the remaining 800MHz spectrum after MTN acquired 20MHz and Vodafone 10MHz, the review did not focus on any value leaks parameters at all.

GSMA (2019) analysed the mobile economy in West Africa. Although their finding revealed that in Ghana, Huawei is collaborating with the government and MTN to address the rural connectivity challenge through lightweight rural network coverage solution supporting 2G, 3G and 4G connectivity but with no mention of value leaks in this key project. Lastly, Chichester, Pluess and Lee (2017) made recommendations for the telecommunication sectors in Sub-Saharan Africa in their study but not focus on the concept of value leaks, as indicated in Table 1.4.

However, considering the huge investments that have been made into the telecommunication sector from 2014 to date, as shown in Table 1.3, there is a need to ascertain the occurrence of value leaks in its entirety, and also the contributory factors to the telecommunication industry in Ghana.

1.4 PROBLEM STATEMENT

The issue of value leaks is prominent in project management. More so, a project's ability to avert and control them can either make or break value success (Keen, 2011). The negative effect of value leaks in the form of time and cost overruns on project completion has become a global canker which is prevalent in telecommunication sector projects; for example, in the erection of cell sites (masts/towers) for network expansion (Danso & Antwi, 2012). Although, such overrun is a global phenomenon, it is more severe in developing countries like Ghana (Sweis *et al.*, 2013). The resulting effects of it are harmful to economic growth, particularly in developing countries. This is because the expansion of telecommunication networks contributes significantly to national investments in developing economies (Sweis *et al.*, 2013).

The resulting effects of such overruns have led to clients losing confidence in consultants, increased investment risks and costs, abandonment of projects, as well as the inability to deliver value to clients' in the telecommunication industry (Sweis *et al.*, 2013; Danso & Antwi, 2012; Azhar, Farooqui & Ahmed, 2008). While the occurrence of value leaks may arise from varied causes (time and cost overruns, poor quality, out of scope, team dissatisfaction), EVA appears to focus only on time and cost overruns without demonstrating the leading causes, or their possible sources of origin (Rajhans *et al.*, 2016; PMI, 2013; Lukas, 2008). There are no empirical studies that situate the occurrence of value leaks in the context of EVA techniques. The exclusion of value leaks from EVA, becomes problematic in the measurement of project performance. Therefore, the study aims to avert or minimise the occurrences of value leaks to improve projects success, as there is scant empirical data on their occurrence in the network expansion projects in the telecommunication industry, particularly within the context of Ghana. In view of this, the objectives presented in Section 1.5.1., were formulated to achieve this aim of the study.

1.5 OVERALL AIM OF THE STUDY

The overall aim of the study is to develop a diagnostic model that aids the easy identification, control and remedy of value leaks to minimise the forgone unrealised project value as well as unplanned utilisation of resources.

1.5.1 Research objectives

The following objectives emanated from the overall aim of the study:

- Critically analyse value leaks' causal factors during project management;
- Examine quantitatively, the impact of the identified value leaks' factors on project performance success;
- Explore the impact of different sources of value leaks (stakeholders, project life cycle, and environment) on project performance success; and
- Develop a diagnostic model (conceptual framework) of value leaks during project implementation in the context of telecommunication construction projects.

1.5.2 Research questions

The following research questions were formulated for the study:

- What are the factors that contribute to value leaks during project management?
- To what extent do value leaks impact project performance?
- How do different sources of value leaks (stakeholders, project life cycle, and environment) impact project success?
- To what extent can a diagnostic model of value leaks be developed for project management practitioners in telecommunication network expansion projects?

1.6 DEFINITIONS OF KEY TERMS

There are some key terms used in the study, as briefly explained in Table 1.5. Among the key terms presented are earned value, earned value analysis, value leaks, triple constraints, cost of quality, schedule performance, project stakeholders.

Table 1.5: Definitions of key terms

Key terms	Brief definition
Project	A temporary endeavour required to deliver a unique and expected outcome (PMI, 2017)
Project management	An application of knowledge, skills, tools, and techniques to align resources to deliver the objectives of the stakeholders within the constraints of cost, time, and scope (Nouban et al, 2020; Megh, 2020; Sherif, 2006)
Earned value	A measure of work done against its authorised budget. It helps to determine the percentage work completed on a project (Sackey et al, 2020; PMI, 2017).
Earned Value Analysis	A technique that integrates project time (schedule), cost (budget), and scope (requirements) to measure project performance (Sackey et al, 2020; PMI, 2017).
Value leaks	Project value leak is considered as the forgone benefit opportunity that could have been fulfilled if not for management's slipups (Keen, 2011).
Triple constraints	This entails project cost, time, and scope/quality which have been used traditionally, to measure project performance across various industries (Lam & Adeleke 2020; Pinto & Rouhiainen, 2001; Shenhar & Dvir, 2007).
Cost of quality	This looks at amount of project budget a company loses due to failure to produce the output right for the first time. These costs include rework, duplicate, complaints, loss of customers, and scrapping rejects.
Requirement performance	This measures the degree to which the outcome of a project meets requirements. This includes both functional requirements (what the product is supposed to do) and non-functional requirements (product quality, usability.).
Productivity	This is output produced expressed over unit of input and it measures how efficient project resources (people, budget, etc.) have been utilised.
Time overrun	The late delivery of work activities as against their original planned duration (Al Amri & Marey-Perez 2020; Ismail, 2014).
Project stakeholder	An individual who is impacted by the decisions, activities, and outcome of a project (PMI, 2017).
Project environment	Entails all internal and external factors that influence project success, e.g. industry standards, new technologies, marketplace conditions, labour conditions, and so forth (Ludovico and Petrarca, 2010).
Project life cycle	Represents a series of phases a project goes through from initiation to its closure to deliver the expected outcome of the project (PMI, 2017).
Cost of performance	This is Cost Performance Index (CPI) which measures cost efficiency and it is determined by value of work done (earned value) expressed over the actual cost of work performed.
Schedule performance	This compares the total original authorised duration versus total final project duration. It monitors ability to meet time-to-market window.
Cost overrun	An increase in project cost as against its allocated budget (Al Amri & Marey-Perez, 2020; Love *et al.*, 2013).
Customer satisfaction	This measures whether customers' expectations are met, and it is measured by the Customer Satisfaction Index.
Project cycle time	This looks at the time it takes to complete the project life cycle. Therefore, the shorter the cycle times, the faster the investment is returned to the company (Megh, 2020).

Source: Researcher's own compilation (2019)

1.7 SIGNIFICANCE OF THE STUDY

The issue of value leaks is a novel concept, so this study conceivably contributes immensely to its theoretical developments and practical applications.

1.7.1 Practical implications

In practice, this study would enlighten the perspective of project management practitioners in terms of value leaks, which might traditionally be considered as a slip in their quest to achieve value through projects. The outcome of the models and frameworks to be developed may act as a guide and diagnostic mechanism to create and maintain value through projects for the practitioners, regardless of the industry. It will also show what practitioners should be concerned about and what not, in order to improve value delivery.

1.7.2 Theoretical implications

Noticeably, the value leak during project deployment is a novel concept and this may make the study a thought-provoking one, which might arouse the interest of the academic community for an advanced debate. The outcome of the study would make a substantial contribution to the development of knowledge related to value leaks by strongly suggesting that attention should be paid to the value that leaks, whilst emphasising the creation of overall business value through projects. Furthermore, no previous research is seen situating value leaks into earned value analysis as a measure of project performance; integrating the multiple dimensions of value leaks to assess project performance; establishing quantitatively, the impact of value leaks' causal factors on project performance; determining the sources of value leaks and ascertaining their impact on project success, as well as developing a diagnostic framework to aid in the easy identification, control, and remedy of value leaks to minimise the forgone unrealised project value as well as unplanned utilisation of resources. Therefore, this study could help in closing such gaps existing in the literature.

1.7.3 Methodology implications

The study went through a thorough statistical validation to establish value leaks' causal factors and their sources of origin. The relationships between these value leaks' causal factors and project performance, as well as the sources of value leaks and project success were rigorously tested for consistency and validity. The diagnostic model developed by the current study has been empirically tested through the use of EFA (Exploratory Factor Analysis), CFA (Confirmatory factor analysis) and SEM (structural equation modelling) analyses. Therefore, the measurement system of value leaks and its impact on project performance has been designed to aid and facilitate the conduct of any such study in any industry in future.

1.7.4 Contribution of the study

The contributions of this study as elaborated in Section 7.2, are summarised in this section.

1.7.4.1 Practical contribution

An appreciation of value leaks would help companies and project management practitioners within the telecommunication industry, especially within the context of Ghana, to enhance the achievement of their strategic goals through the successful delivery of their projects. The diagnostic model developed by the current study enables the easy identification, control and remedy of value leaks to minimise the forgone unrealised project value as well as the unplanned utilisation of resources.

1.7.4.2 Theoretical contribution

Several studies have been conducted on time and cost overruns in construction projects worldwide, as well as extending to EVA as a measure of project performance. However, there is no research work that posits value leaks in the context of project management, specifically, in the EVA technique to measure and judge project performance and to develop a diagnostic model (conceptual framework) of value leaks' factors within the context of telecommunication network expansion projects in Ghana.

The research findings are expected to contribute to the contemporary literature in the field of project management. The concept of project value leaks is still new and very little research works have been conducted. Therefore, this research will build on the existing literature for project management professionals to expand their knowledge and conduct further research in that regard.

1.7.4.3 Methodological contribution

The diagnostic model developed from this study is believed to serve as a benchmark methodology, which can be utilised to ascertain the occurrence of value leaks during project deployment, determine its impact on project performance and how to remedy it. Again, both scholars and industry players can use the research instrument that has been developed to carry out a basic pre-test exercise in their studies.

1.8 SCOPE OF THE STUDY

The study focuses on the relevance of incorporating value leaks into EVA in measuring project performance, with particular reference to network expansion projects in the Ghanaian telecommunication industry. The study is positioned within the field of project management in the telecommunication industry.

1.8.1 Assumptions and limitations of the study

The basic assumptions of the study were as follows:

- The busy schedules of the project management practitioners would not influence their ability to answer the interview questions.
- The participants' gender and their race would not significantly influence their perceptions and standpoints.
- This study presumed that research participants would truthfully answer the interview questions and accurately complete the questionnaires to the best of their ability.

In view of the study's limitations, firstly, the study used a network expansion project, which is just one of the key projects in the telecommunication industry, restricting the generalisability of the findings to other telecommunication projects. Secondly, the study used only the interview method to ascertain the amount of value leaks during project deployment from the participants, due to the MNOs placing restrictions on access to documents which did not allow the researcher to add on a review of documents and observation methods. Thirdly, among the various measures of value leaks, the research addressed time overruns, cost overruns, not meeting requirements, poor quality (rework) and project team dissatisfaction as the key measures of project value leaks.

1.9 PREVIEW OF RESEARCH METHODOLOGY

The section presents the highlights of the research design and methodology employed in the study.

- ***Research philosophy:*** the researcher assumed a pragmatism worldview as it gives freedom as to the choice of methods, techniques, and procedures that best meets the study's need (Creswell, 2014). Also, the world is not an absolute unit that necessitate a single system of philosophy and reality (Creswell, 2014; Morgan, 2007).
- ***Research design:*** the study adopted a mixed-methods approach as it lays the grounds for a pragmatic philosophical worldview to make enquiries into the research (Creswell, 2014). The mixed-method approach was selected as it inspires confidence in research findings by providing sufficient evidence to mitigate the weaknesses associated with a single method approach (Caruth, 2013; Creswell & Plano Clark, 2011; Bryman, 2004). In view of this, an exploratory sequential mixed method was adopted to explore the concept of value leaks from the qualitative perspective, and subsequently, the impact of value leaks on project performance was quantitatively determined.
- ***Qualitative research (Phase I): Case study strategy:*** the study used four (4) different companies out of a possible nine (9) that work on network expansion projects, either as the project owner (mobile network operators) or the contracting vendors (tower companies and managed-service vendors) (National Communication Authority in Ghana, 2019; Osei-Owusu & Henten, 2017). The study selected two (2) senior project management practitioners from each network operator and one (1) from each contracting vendor through purposive sampling. Their functional roles range from project/rollout manager to programme director, and all of them are highly recommended based on their in-depth understanding, knowledge and level of experience on network expansion projects in their respective companies.
- ***Qualitative data collection technique:*** Semi-structured interviews, specifically face-to-face interviews were adopted to collect data in the selected companies (Sekaran, 2003; Robson, 2002). All the interviews were conducted after office hours between 6 pm and 8 pm to avoid the interruptions which might have arisen

during working hours. The interviews' duration ranged from 47 minutes (shortest) to one hour and 22 minutes (longest).

- ***Qualitative data analysis:*** the study used the software program, Atlas.ti to code the data for analysis, as manual coding is considered to be a laborious and time-consuming process, and using such a program is a faster and more efficient way of storing and locating qualitative data (Creswell, 2014). The findings culminated into the design of the questionnaire for the survey.
- ***Quantitative research (Phase II): Survey strategy:*** According to Saunders *et al.* (2012), a survey strategy is mostly adopted to respond to questions in the form of 'who', 'what', 'where' and 'how'. In line with this, the study generated the following statistical hypotheses to test the relationship between value leaks' possible sources and project success:
    - H_1: *Project stakeholder is a source of value leaks because its causal factors have a strong negative relationship with project success.*
    - H_2: *Project environment is a source of value leaks because its causal factors have a strong negative relationship with project success.*
    - H_3: *Project life cycle is a source of value leaks because its causal factors have a strong negative relationship with project success.*
- ***Population and sample under survey strategy:*** A target population with nine companies warranted a census study, however, the study selected eight (**three** out of a possible four mobile network operators, all **three** tower companies, and **two** key managed-service vendors) as the sample size through the use of the convenience sampling method. This was owing to the ninth company's lack of easy accessibility and unwillingness to participate in the study, as asserted by Etiken *et al.* (2016). The study used a simplified formula developed by Yamane (1967, cited in Islam, 2018) to ascertain the accessible population sample size of 187 individual employees with direct project management responsibility on cell site projects. These individuals were selected through a proportionate stratified random sampling technique (Sekaran, 2003).
- ***Survey data-collection technique:*** the study used self-administered structured questionnaires and a Likert scale questionnaire based on a 5-point rating system:

5-Strongly agree; 4-agree; 3-neutral; 2-disagree; and 1-strongly disagree (Sekaran, 2003).

- ***Data analysis under survey strategy:*** the study used both univariate and multivariate data analysis techniques through the application of IBM Statistical Package for Social Sciences (SPSS) AMOS version 25.0. Specifically, exploratory factor analysis (EFA), confirmatory factor analysis (CFA) and the structural model were carried out to minimise the data and achieve the overall objectives of the study.

1.10 CHAPTER LAYOUT

The figure below illustrates the structure of the thesis with short descriptions on each chapter as a preview.

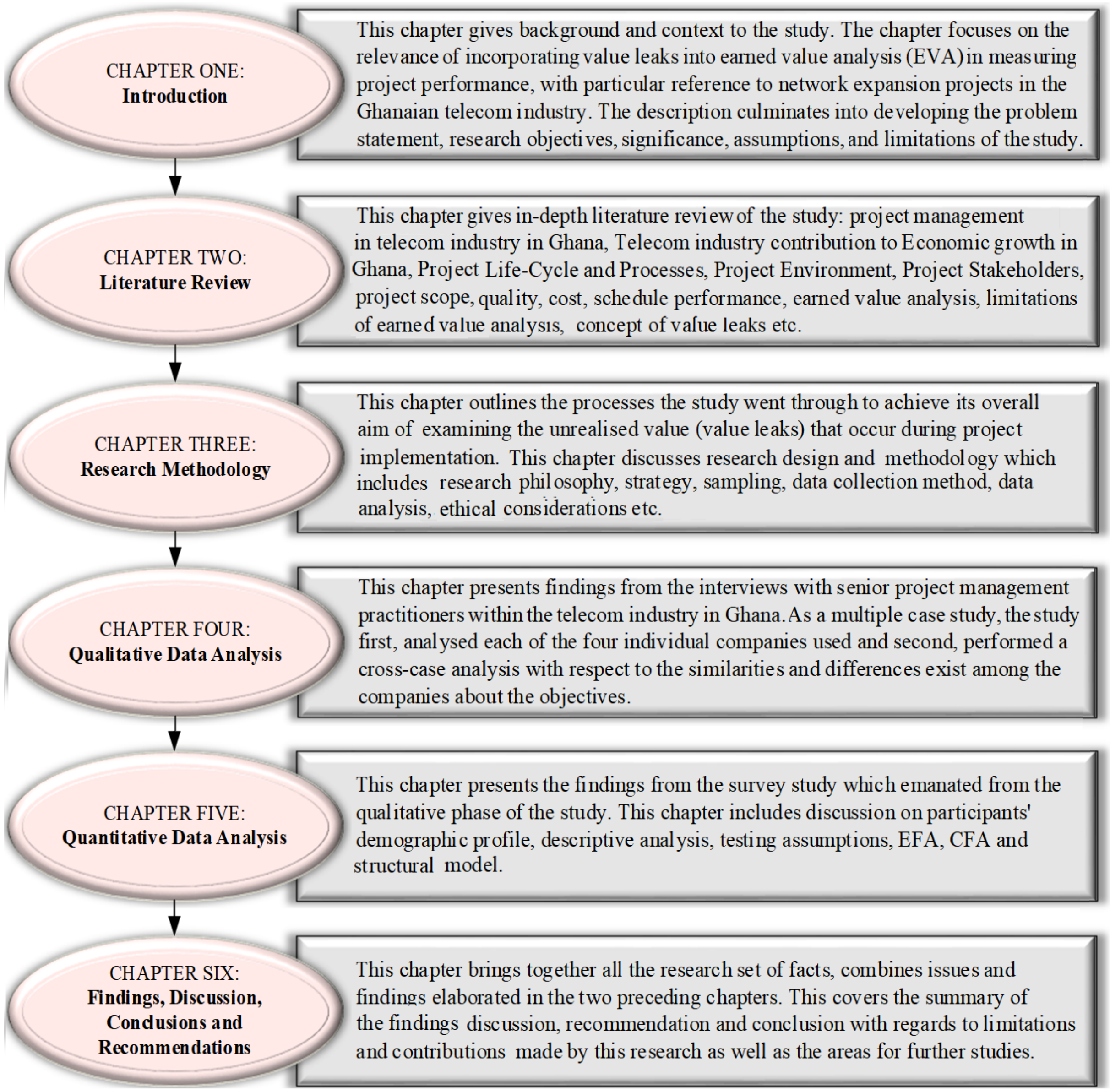


Figure 1.3: Thesis chapter layout

1.11 SUMMARY OF CHAPTER 1

This chapter elucidated on the background and context to the study. In view of this, the chapter explained the relevance of the study and provided the rationale for including value leaks into earned value analysis (EVA) in measuring project performance, with a specific focus on network expansion projects in the Ghanaian telecommunication industry. The description culminated into developing the problem statement, research objectives, significance, assumptions, and limitations of the study. The next chapter presents an extensive review of the existing literature on the topic of the study.

CHAPTER 2:
LITERATURE REVIEW

2.1 INTRODUCTION

This chapter provides a comprehensive discussion of the literature review which was highlighted in Chapter 1. This extensive review covers: (i) the concept of project management in the telecommunication industry; (ii) theoretical background to the study; (iii) earned value analysis (EVA); (iv) project value leaks; (v) the sources of project value leaks, and (vi) the conceptual framework of the study, as demonstrated in Figure 2.2.

2.2 THE LITERATURE REVIEW PROCESS

In conducting a literature review, Rowley and Slack (2004) proposed that the tools and search methods used to obtain the literature must be disclosed by the researcher. In view of this, the study adapted the systematic literature review of value metrics as proposed by Bertoni *et al.* (2017), and the five principles of systematic review developed by Denyer and Transfield (2009) to illustrate the tools and search methods used to obtain the literature as illustrated in Figure 2.1.

Denyer and Transfield (2009) argued that the ultimate aim of preparing a review is to outline its focus, and this is achieved effectively by involving experts in the subject area in framing the study questions. In view of this, two experienced Network Rollout Managers in the telecommunication industry and an experienced PMP Instructor were consulted to formulate the questions outlined in Section 1.5.2 in the previous chapter. After establishing the review questions, Bertoni *et al.* (2017) argued that keywords for the search must be defined from the set of questions. The study therefore grouped the keywords into five (5) sets as shown in Figure 2.1.

In locating studies, this study relied on electronic databases such as ResearchGate and ScienceDirect; and project management-related books, especially PMBOKs. With respect to year of publication, the search spanned the period from 2005 to 2019, which was believed to have provided all the relevant information within the context of project management. Albeit, some key historical data beyond the specified period was searched in addition to enrich the study. The keywords listed below in Figure 2.1, as sets 1, 2, 3, 4 and 5, were used for the search including snowballing with both forward and backward methods (Wohlin, 2014), from one publication to the other. The findings were categorised and reviewed, resulting in the retrieval of only essential contributions to the subject matter.

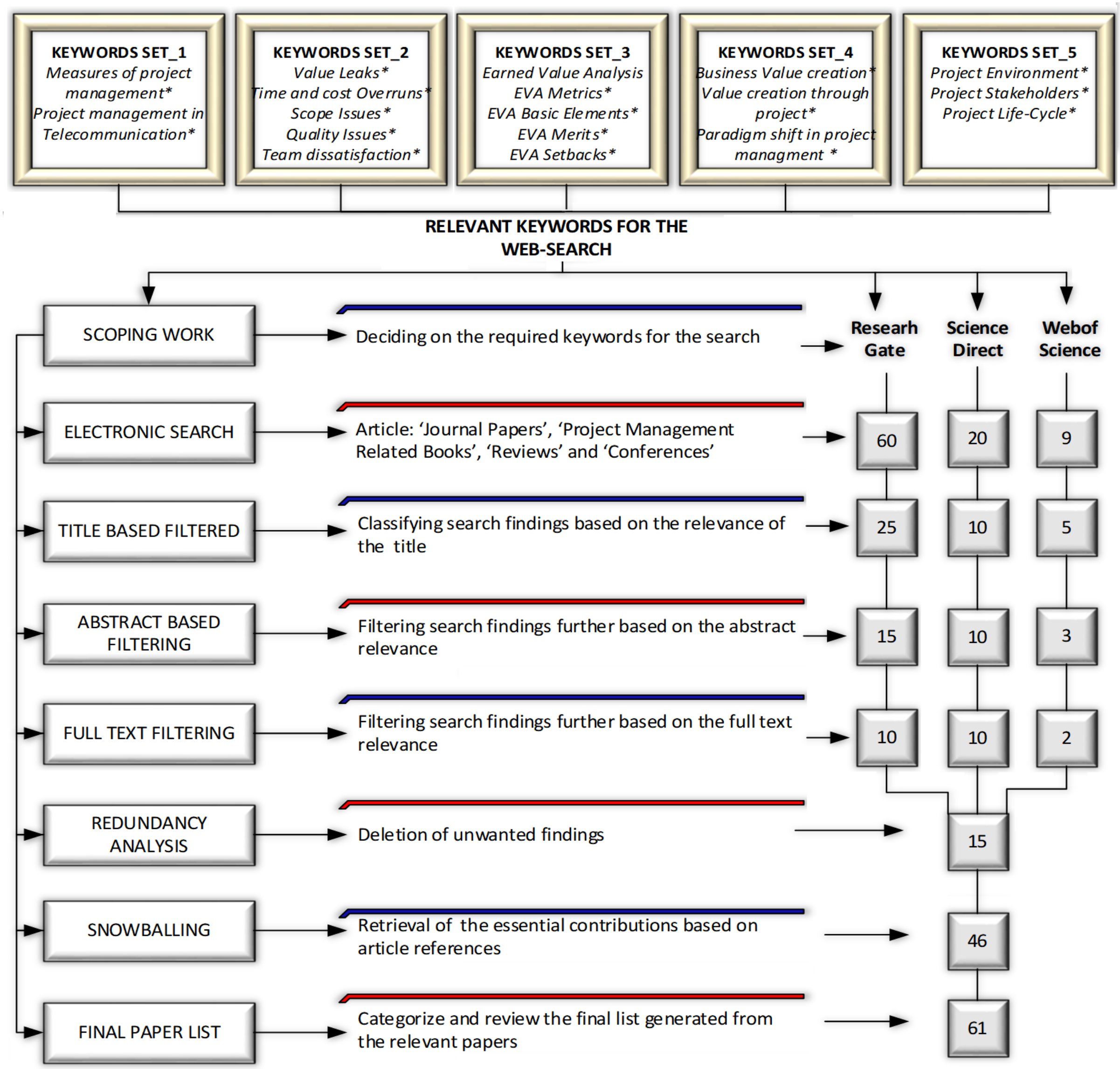


Figure 2.1: The systematic process of literature review

Source: Adapted from Bertoni *et al.* (2017) and Denyer & Tranfield (2009

Furthermore, the study used an explanatory method, as proposed by Denyer and Transfield (2009), to explain the outcomes of the search with the support of concept mapping advocated by Novak and Canas (2006), which emphasises the use of figures to illustrate ideas. Finally, exactly what is known and unknown about the questions resulting from the search are laid out in Figure 2.2 and further elucidated.

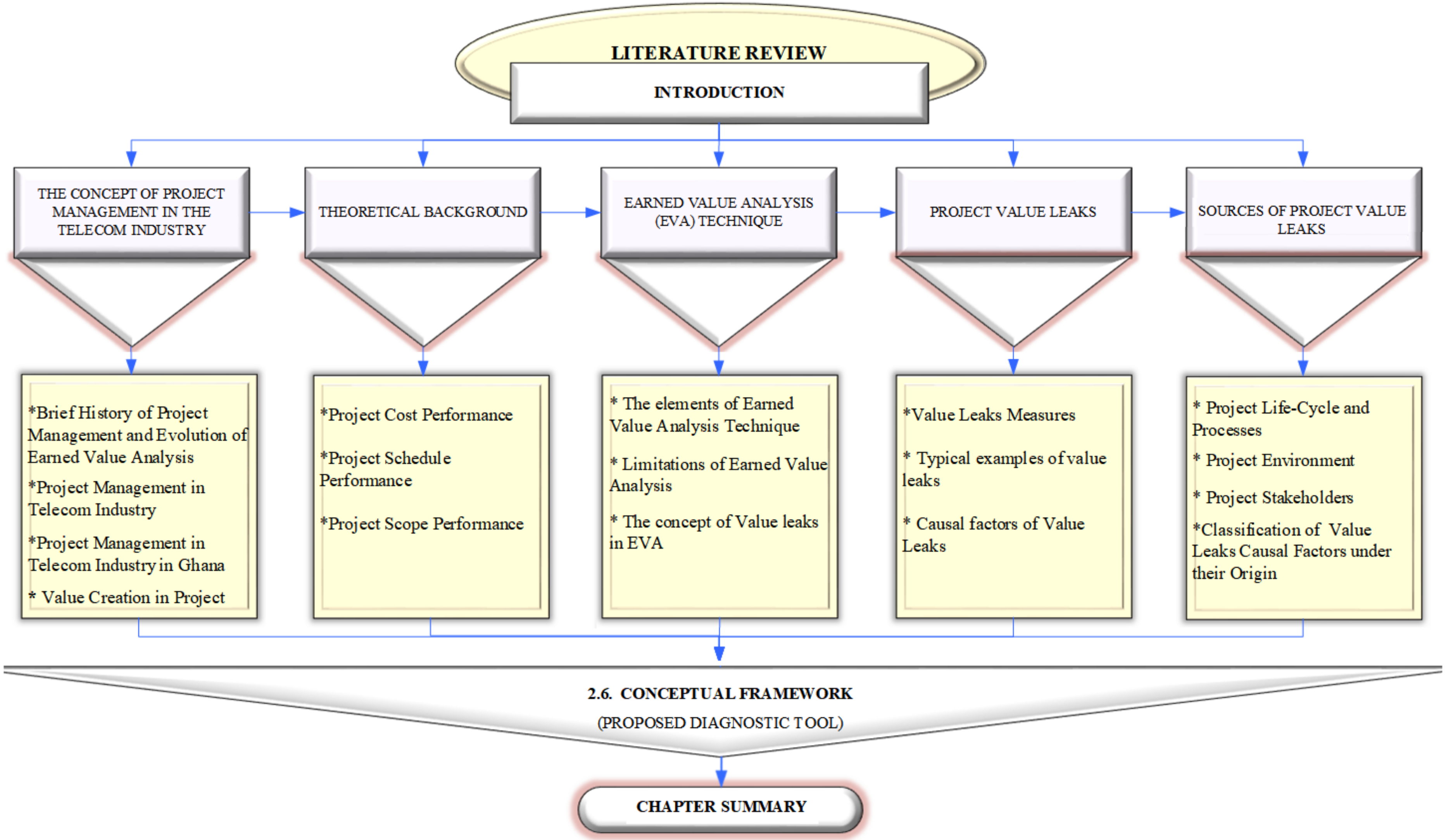


Figure 2.2: Literature review layout

Source: Author's own compilation (2019)

2.3 THE CONCEPT OF PROJECT MANAGEMENT IN THE TELECOMMUNICATION INDUSTRY

The section presents a brief history of project management and the evolution of EVA, definitions of project management, project management in the telecommunication industry, and project management in the Ghanaian telecommunication industry.

2.3.1 Brief history of project management and the evolution of EVA

Project management is a unique concept which originated from World War II as a response to war-related operational problems. The need for project management arose because the classical management techniques were inadequate to effectively handle project-related activities. This was partly due to the fact that the classical management structure and functions were too mechanical, and product intended, as opposed to the approach of project-oriented organisations, which tended to focus on the objectives on which projects were developed. Thus, the emergence of project management sought to safeguard the time overruns in production and delivery, resource wastage, high cost, as well as project the uncertainties (Venter, 2005).

The concept of projects gained prominence following World War II, with its adoption gaining momentum in terms of project sizes and complexity. By the 1950s, the concept of a project had completely shifted, thus defying all existing methods of project planning. This resulted in massive cost and schedule overruns (Nicholas & Steyn, 2012). In an attempt to circumvent the situation, PERT and CPM were developed to facilitate the planning, scheduling and controlling of complex projects. These interventions became applicable to entities like the navy in their interrelated work activities with the DuPont Corporation in 1958 (Nicholas & Steyn, 2012).

Due to the inefficiency of these techniques, network modifications were made to integrate project cost accounting with project scheduling. The newly developed modifications gained prominence in the 1960s, making activities involving Cost Schedule Control Systems (C/SCS) mandatory by law. CSCS was particularly enforced in the Department of Defence, as well as within contracts involving NASA (Nicholas & Steyn, 2012). However, the issue of overruns had still not been resolved. Thus, in the 1970s, EVA came into being as a project tracking concept. This concept introduced Project Performance Measurement systems which were used to track budget expenditure, and the overall percentage of work completion (Nicholas & Steyn, 2012). A disadvantage of EVA is its inability to clearly identify the factors that cause the occurrence of time and cost overrun factors, which are key contributors to value leaks, and relevant in measuring project performance (Rajhans *et al.*, 2016; PMI, 2013; Lukas, 2008).

While it is evident that project management cannot be ascribed to one industry alone (Nicholas & Steyn, 2012), it is more adopted and prevalent in the telecommunication industry (Vorex, 2015) hence, the discussion on project management in telecommunication industry below.

2.3.2 Project management in the telecommunication industry

According to Balashova and Gromova (2017), the telecommunication industry is becoming increasing significant due to its role in the globalisation of the world economy and in scientific and technological advancement. More so, telecommunication has facilitated the upsurge of business activities in society today, increasing connectivity on a national and global scale. This necessitates the pressing need for agile project management methodologies to effectively manage the uncertainties which are likely to be associated with these day-to-day activities (Balashova & Gromova, 2017).

According to Vorex (2015), project management is essential to managing growth in the very competitive telecommunication industry. Fierce competition among MNOs ensures that the telecommunications are constantly revising their business strategy to gain a competitive advantage over one other. Among others, the MNOs review their strategic goals, adopt new technology services and product offerings, and reduce their time-to-market for service delivery in order to stay ahead of the competition (Ludovico & Petrarca, 2010). Some of the upgrades in telecommunication have seen the expansion of network facilities, deployment of additional cell sites and masts, and the upgrading of node software. MNOs have also introduced 3G and 4G networks and have established billing platforms on their various networks (Al Zadjali *et al.*, 2014).

Sherif (2006b) conceptualised the importance of project management in the telecommunication industry for the following four main reasons:

- The demands of regulatory compliance and technological advancement necessitate the adoption of project management techniques in the telecommunication industry.
- The duration of infrastructure development and the number of people involved in such activities, for example, suppliers, contractors, government, and communities, require the concept of project management to be able to manage them.
- The existence of different forms of telecommunication services which ranges from wireless access, mobile internet, broadband, to corporate services.
- Environmental factors, such as the need to meet evolving customer needs coupled with competitor activity requiring telecommunications to stay operational and competitive. It can therefore be argued that the environmental factors and activities of stakeholders could influence the adoption of project management in the telecommunication industry.

To gain a competitive edge in such an industry, Vorex (2015) outlined the following three key reasons why every MNO should adopt project management in their activities:

- **Utilisation of time and resource**

  The management of time and resources is vital to the ability of companies to grow and expand their operations. Essentially, the management of projects requires the adherence to strict deadliness for efficient performance in order to stay competitive.

- **Collaboration and communication**

  Vorex (2015) indicated that about 57% of projects fail as a result of poor team communication. The multi-faceted nature of projects requires that responsibilities should be allocated to different functions. Teamwork is even more essential in the telecommunication industry, where there is a multiplicity of project activities. Projects follow specific trackable procedures with strict deadlines. Therefore, with effective project management, MNOs can ensure proper collaboration among its team units through effective communication. This will also help them to save cost as a result of improved productivity.

- **Project management is a must-have in the telecommunication industry**

  Vorex (2015), in citing PricewaterhouseCoopers, estimates that only 2.5% of companies that undertake projects are able to see them to completion. Thus, the more complex a project becomes, the more likely it is to fail.

According to Desmond (2006), the telecommunication industry has undergone several changes since its inception. Some of which include migration from operator connection to direct dial; transition from analogue to digital transmission, and the rise of the internet. Balashova and Gromova (2017) argued that the telecommunication industry is one of the most significant sectors in the world economy which touches all spheres of life, especially propelling the functions of other industries and the country at large. Similarly, Ludovico and Petrarca (2010) have added that the present telecommunication environment has seen the addition of new operators and mobile virtual network operators to existing MNOs, thus resulting in rapid changes to strategies, project scope swings, company changes, merges and acquisitions, consolidations and re-organisations.

The above discussion is a reflection of the situation in the telecommunication industry in Ghana. The Ghanaian telecommunication sector has experienced major changes spanning industrial liberalisation, the influx of foreign MNOs, mergers and acquisitions, network expansions, as well as the launch of competitive products (Ofori, 2013; Ofori & Sakyi, 2006).

Having established the importance of project management in the Telecommunication industry at large, it is imperative to view it from Ghana's perspective, as the choice of country for this study.

2.3.3 Project management in the telecommunication industry in Ghana

This section presents an overview of project management in the telecommunication industry in Ghana, provides a synopsis of MNOs and their tower companies that undertake projects within the telecommunication industry, and discusses the types of undertaken projects, costs of the projects, and the industry contribution to economic growth and social development.

2.3.3.1 An overview of project management in Ghana

According to Ofori and Sakyi (2006), the adoption of project management practices in Ghana can be traced as far back as the 1960s. At the time, project management was used primarily as a tool to achieve developmental initiatives, although there was limited knowledge of project management. This necessitated the intervention of foreign donors who provided funding, particularly in the 1980s, to aid the development and restructuring of key sectors in the Ghanaian economy using efficient project management methods.

Furthermore, project management is considered as a powerful tool with which various business employ to gain a competitive advantage. According to Ofori (2013), the continuous adoption of project management by corporate Ghana in pursuing their business goals and objectives is proof that the concept can be successfully applied across multi-faceted, competitive business environments.

The application of project management concepts in Ghana is predominantly observed in the telecommunication, manufacturing, real estate, and extractive industries. IMANI Ghana (2017) posits that the Ghanaian telecommunication industry is one of the strongest and most competitive in West Africa. Following its liberalisation and deregulation in the 1990s, the sector has seen significant growth and increased technological transformation. This has bred intense competition among service providers in the industry. To this effect, Ghana has become part of the leading countries in Africa that promote telecommunication services by exposing its basic telecommunication industry to private competition.

While much of the success chalked up to the telecommunication sector could be attributed to efficient project management practices (Ofori, 2013), it is evident that there are some deficiencies that impede the application of the concept. They include the issue of value leaks. To date, there is little or no research work to assess the project value losses that go unrealised, which when not checked, stall the project management process.

It is based on this premise that this study was commissioned in order to ascertain the factors that have the potential to cause value leaks. The study also aimed to attempt to identify the origin of these factors and deduce ways to mitigate their impact on project management performance in the telecommunication industry in Ghana. In the following section, key mobile operators in the Ghanaian telecommunication industry are discussed, shedding light on how they stay competitive in their operations.

2.3.3.2 Mobile network operators and their tower companies

According to the National Communication Authority of Ghana (NCA) (2017), there are six MNOs in Ghana, namely, Mobile Telecommunication Network (MTN), Millicom Ghana Limited (Tigo), Vodafone Ghana Limited (Vodafone), Bharti Airtel (Airtel), Expresso Ghana (Expresso) and Glo Mobile Ghana Limited (Glo). This evidently points to the competitive nature of the industry in the country (Tobbin, 2010). Figure 2.3 shows the current active mobile network operators in the telecommunication industry in Ghana, some of which have spent significant amounts of money on their service products to stay relevant on the market.

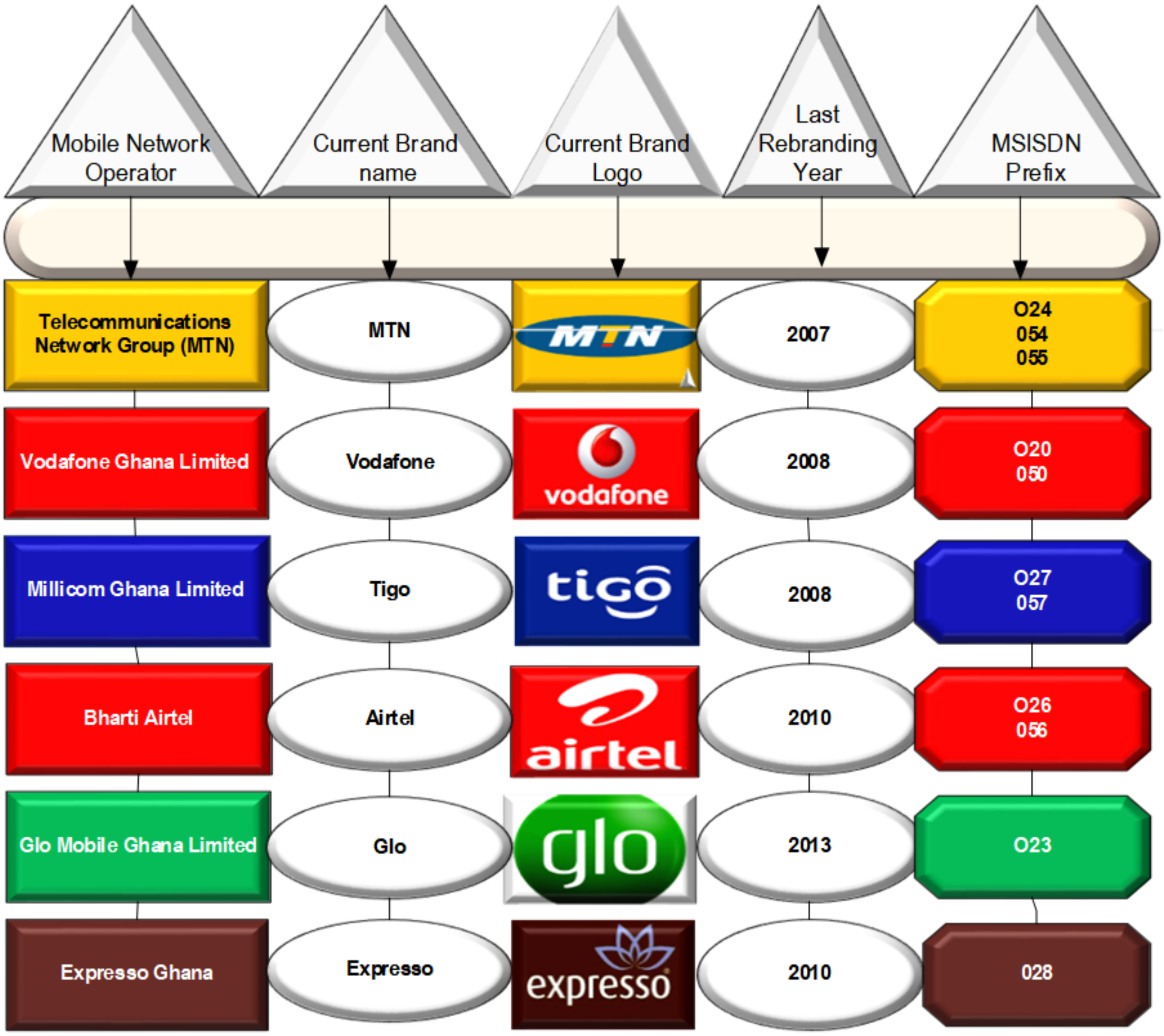


Figure 2.3: The current mobile network operators in Ghana

Source: Author's own compilation (2019).

These operators have made investments in imaging and branding, number prefix, and more importantly, in network expansion projects. In terms of market size, MTN is the market leader, with a total subscriber base of 16 969 311. They are followed by Vodafone Ghana Limited who have a total subscription of 8 651 515 customers. Tigo is the third market leader with 5 187 936 subscriptions. Airtel comes fourth boasting a subscriber base of 4 398 913. They are followed by Glo in fifth place at 753 341 and Expresso in sixth with 23 264 subscriptions (NCA, 2017).

In addition to these mobile network operators (MNOs), there are three companies that have been authorised by the NCA to own and manage cell towers on behalf of the MNOs in Ghana. These companies are American Tower Company (ATC) Ghana, Eaton Towers Ghana Limited and Helios Tower Ghana (HTG) Managed Services Limited (NCA, 2018).

Table 2.1 presents a list of some existing towers owned by the authorised tower companies.

Table 2.1: Market share of tower companies in Ghana's telecommunication industry

Tower company	Estimated number of active towers nationwide by end of 2017	Estimated market share	Estimated MNOs share %
American Tower Company	3500	61	MTN (80%) Airtel &Tigo (10%) Others (10%)
Eaton Towers Ghana Limited	1350	23	Vodafone (60%) Airtel (30%) Others (10%)
Helios Towers Ghana Limited	900	16	Tigo (70%) Airtel (20%) Others (10%)
Total	**5750**	**100**	**100**

Source: Adapted from Osei-Owusu & Henten (2017)

Research suggests that among the types of projects implemented in the telecommunication industry, network expansions, including the building of network towers, constitute a large proportion of capital investments (Osei-Owusu & Henten, 2017). The cost of building a network tower alone is estimated to be US$ 250 000 (Hatsu *et al.,* 2016). Therefore, the high risks associated with investment in telecommunication require the identification of factors which could impact on project delivery so as to realise a return on investment.

2.3.3.3 Network expansion projects and costs

Network expansion projects in the telecommunication industry comprise the installation of satellite antennas, erection of new cell sites, the mounting of towers/masts, adding on enhancements and expanding on the capacities of existing cell sites (Sherif, 2006; Desmond, 2004).

The undertaking of network expansion does not come cheap. The high costs involved pose a major problem to service providers (Hatsu *et al.*, 2016). Prior to trade liberalisation in Ghana, the state-owned enterprise, Ghana Post and Telegraph (GP&T) undertook network expansion projects to extend coverage nationwide. The intervention by GP&T led to increase in the access to telecommunication services through the First Telecommunication Project (FTP) and Second Telecommunication Project (STP) initiatives. FTP is estimated to have cost a total of $76 million over the four-year duration of its rollout, while a total budget of $172.7 million was allocated to the STP over a period of eight years (from 1975 to 1987 in total) (Tobbin, 2010).

The FTP, although it had an initial four-year timeline (from 1975 – 1979), encountered some schedule overruns, thus extending the actual delivery time to 1985. Consequently, the expected objective was not fully realised (Tobbin, 2010). This means that the total expected project value was not realised due to the occurrence of time and cost overruns, which are key elements in the value leak.

This also gives an indication that even before trade liberalisation, there was an occurrence of project value leaks in the Ghanaian telecommunication industry. Consequently, the effects of trade liberalisation, coupled with the introduction of the Acceleration Development Policy (ADP), saw the removal of barriers of entry into the telecommunication sector. It also resulted in the inception of many infrastructure projects, thereby boosting the entry of MNOs into the sector (IMANI Ghana, 2017). The section below elucidates on the cost implications of network expansions for telecommunication operators in Ghana.

- **Tigo network expansion project cost**

Dowuona (2015) indicated in his publication that as of 2015, Tigo had spent up to US$24 million on network expansion and improvement projects. The projects succeeded in adding 140 3G new base stations, or cell sites, to their existing infrastructure. Tigo also undertook battery replacements during this period, but unfortunately incurred losses due to theft at the operator’s base stations and cell site locations. This set the company back by up to US$100 million (Dowuona, 2015).

In 2016, Tigo again unveiled an ultra-modern data centre costing US$5.1 million. At the launch of this project, Mr Reddick, then Chief Technical and Information Officer (CTIO), stated that the US$5.1 million centre has a 110 rack capacity which would accommodate all Tigo network infrastructure. It will also ensure that subscriber data is properly stored and managed in accordance with Ghana’s Data Protection Act (Act 843) (Citifmonline.com, 2016).

In spite of the minimal availability of value leaks data, Danso and Antwi (2012) observed that 35 to 55% of Tigo-implemented projects from 1992 to 2011 experienced as much as 82% of time overruns, with project costs increasing by 50%. This information, set against the huge investments that have been made by the operator from 2014 to date (as shown in Table 1.3), necessitates urgent attention to the occurrence of value leaks and its contributing factors in the telecommunication industry in Ghana.

The next MNO under review is MTN’s Network Expansion Project Cost.

- **MTN Network Expansion Project Cost**

In a meeting by Journalists for Business Advocacy in 2015, Mrs Lumor, the Corporate Service Executive of MTN, indicated that MTN has from 2006 to 2014, spent over US$2.4 billion on network expansion and systems improvement. The results evidenced in network capacity increment, improved data connection, and minimised network congestions (GNA, 2015).

In 2015, MTN launched the first ever 4G project in the telecommunication industry at a cost of US$67.5. This saw the deployment of 400 4G cell sites or base stations in the regional capitals in Ghana. The following year, the mobile operator invested up to US$18 million in deploying a total of 475 4G LTE sites (4G LTE is the fourth generation of mobile phone communication technology standard beyond 3G) to expand 4G network coverage nationwide (mtn.com.gh, 2015). Moreover, during her address in an editors' meeting in 2017, Mrs. Lumor confirmed the MNO's intention to expand its network by deploying additional 197 4G sites to its existing number. The project, which will cost up to US$ 143.7 million, will also factor in the building of 561 new 3G sites and upgrading old ones to accommodate the increasing subscriber demands (GNA, 2017).

Indeed, MTN has carried out a US$143.7 million capital expenditure which has resulted in the rollout of 672 4G sites (kasapafmonline.com, 2018). Beyond this, MTN paid over GH₵ 605 million in taxes to the Government of Ghana in 2014, while spending in excess of GH₵ 20 million on corporate social responsibility in the areas of education, health and economic empowerment.

Vodafone's Network Expansion Project Costs are discussed next.

- **Vodafone Network Expansion Project Cost**

At a round table discussion to highlight the progress and challenges of the telecommunication industry in Ghana, Mr Amankwah, the Corporate Communications Manager for Vodafone, indicated that from 2007 to 2014, Vodafone spent up to US$1.7 billion on network expansion, specifically to upgrade its network infrastructure (GNA, 2015). Vodafone also spent US$700 million in 2015 to expand and improve its network quality (Myjoyonline.com, 2015). Similar to the situation for the other MNOs, there is no study that has determined the unrealised value in Vodafone's network expansion projects.

- **Airtel Network Expansion Project Cost**

According to Laary (2015), Airtel spent GH₵ 200 million, which is approximately US$ 60 million, on a nationwide network expansion in 2015. With such investments, the potential cost, time and quality overruns that might arise and impede the ability to realise the expected value of the projects have not been determined by any study. Therefore, this study sought to determine the factors that cause such occurrences in undertaking network expansion projects in this industry.

2.3.3.4 Telecommunication industry's contribution to economic growth in Ghana

In an interview at the 5th anniversary of the Ghana Chamber of Telecommunication (GCT) in Accra, Mr Sakyi-Addo, CEO of GCT, highlighted the telecommunication industry's contribution to the growth of the Ghanaian economy. These economic contributions have been in the form of taxes and regulatory payments, job creation, mobile money transactions and corporate social responsibility. The telecommunication industry has contributed significantly to tax and regulatory payments in Ghana. According to Mr Sakyi-Addo, telecommunication companies paid a total of GH₵ 4.92 billion to Ghana's tax revenue from 2011 to 2015. Moreover, the total taxes collected from the companies amounted to 6.9% and 5.4% of the nation's total tax revenues in 2013 and 2014 (Quist, 2017). MTN, the industry's market leader, incurred over GH₵ 1 billion in taxes between 2015 and 2016, and made payments of GH₵ 398.4 million as part of regulatory requirements to the National Communication Authority within this period (Quist, 2017).

The industry has also contributed to creating job opportunities and improving economic activities in the country. According to Koufie *et al.* (2010), as quoted by Arthur (2016), street hawkers, corner shops and small kiosk vendors have become increasingly engaged in the business of selling SIM cards and airtime scratch cards of telecommunication companies in Ghana. The influx of smartphone business has also provided an avenue for sales activities, particularly among the young. In the financial sector for example, banks are offering mobile-based services through airtime purchases, balance statement checks, and tracking of transaction history, among others. Furthermore, mobile operators, like MTN, have over the last 10 years invested US$13 million in Corporate Social Responsibility activities, including the construction of health and educational infrastructure, and funding technical skills training in the country (Adam, 2017). Vodafone and Airtel have also contributed their quota in enhancing cultural and talent development activities (Oppong, 2016; Boateng, 2014; Dowuona, 2009).

The end result of this study thus extends beyond just ascertaining and addressing the issues confronting the MNOs within the telecommunication industry in Ghana; it also factors in the industry's contribution to the economic development of the country.

2.4 VALUE CREATION IN PROJECTS

Traditionally, the deliberations on the concept of value can be traced to the era of Plato and Aristotle, as well as Adam Smith in 1776. In view of this, a study by Ng and Smith (2012) on an integrated framework of value affirmed that this discussion on the concept of value has lasted over 2 000 years, with countless distinctions. Ng and Smith (2012) argued that it is imperative to appreciate how value is created but they were silent on establishing the possibility of value leaks in the process of creating value to satisfy shareholders.

Similarly, a study by Bowman and Ambrosini (2000) on value creation versus value capture, asserted that the existence of every company is to create value, and the resources in the form of labour serve as a value creation source. They further added that a firm creates use value to grasp exchange value, making profit a real value obtained by the business. In creating such a value, it can be argued that the likelihood of the occurrence of value leaks is extremely high, so it needs to be carefully monitored whilst delivering the needed project value.

Furthermore, the modern literature on project value creation is silent about the possibility of value leaks occurring during project implementation. Project value, as explained by Baratta (2007), is used to ascertain the acceptance of a project during closure. According to the author, actual project value is measured in terms of the actual business success of the project. Too and Weaver (2014) also explain project value as the tangible and intangible benefits surpassing the cost of the project. In addition, Sánchez-Fernández *et al.* (2017) argue that project value is considered to be a cognitive trade-off between benefits and sacrifices. Hence, value is realised when the organisation utilises project outcomes, such as product, service, and result, to achieve the purpose for which the project was initiated (Jenner, 2012).

In terms of value creation, Osterwalder *et al.* (2014) affirm that it encompasses all the undesirable feelings and costs, as well as the risks the end-users/ customers face after delivery of the project outcome. Moreover, without the commitment and support of top management, a project cannot accomplish the anticipated business benefits to the company (Too & Weaver, 2014). Meanwhile, Payne and Holt (2001) have argued that value constitutes the core facet of organisational business strategy and success, which in turn, depend on how much value is being created for its customers. The effective management of an ongoing business operation thus results in value creation. Furthermore, effectively applying project management skills will lead to accomplishing significant business value from project investment (PMI, 2013). Essentially, the value of a project, which is considered as the explicit and implicit functions created by the project, is able satisfy the clear and unspoken needs of the stakeholders (Zhai *et al.*, 2009).

From the above discussion, it is evident that the value of a project is its ability to accomplish business success from undertaking the project. Project value is determined after the delivery of the project outcome to its end-users or customers. Project value that goes unrecognised or unrealised due to time, cost and quality overruns is considered as value leaks within the context of this study. In line with this, Baratta (2006) argued that although a project value can be highly positive with regards to business success, it is still predisposed to time and cost overruns. Cost and time are meaningless on their own but are, however, used to determine how much value has gone unrealised during project management (Baratta, 2007).

To conclude on the assertion by Baratta (2007), the occurrence of time and cost overruns means there is forgone value in the project management which form parts of the elements of value leaks, as discussed extensively. Therefore, there was a need to undertake this study to determine value leaks' causal factors and their impact on project performance.

2.5 THEORETICAL BACKGROUND

This section introduces, explains and critiques the triple constraint theory, namely, cost, time and scope, as the theoretical approach employed in this study. Traditionally, cost, time and scope, also known as the Iron Triangle, have been used to measure project performance across various industries (Vurzuh, 2004; Wang & Huang, 2006; Lewis, 2001; Pinto & Rouhiainen, 2001; Shenhar & Dvir, 2007). Therefore, the completion of a project on time, within cost and within scope has become a standard mantra to assess the success of a project (Turner, 2009). Moreover, research has endorsed these three factors as the criteria to measure project success (Wateridge, 1995; Pinto & Slevin, 1990; De Wit, 1988; Morris & Hough, 1987).

According to Desmond (2006), telecommunication projects are measured on time, on budget, within scope and on quality. Similarly, Pedro *et al.* (2011) describe project management as a success when it is delivered within time, on the cost and at high quality, although, elements like productivity, consumption of raw materials and waste may be considered as well. Some authors (Muller & Jugdev, 2012; Shenhar & Dvir, 2007; Nakashima *et al.*, 2006) have argued that during project execution, project performance should be measured with the triple constraints (on time; on scope and on cost). With this view, Koelmans (2004) explained that typically, in the quest to achieve project success, every project has three basic constraints which influence projects delivery. These constraints are time (project bound by a specific timeliness); cost (customers want value for money, but project budget is very tight due to scarce resource), and scope/quality (metrics to ensure project end result conformance to standard). In support of the assertion by Koelmans (2004), Turner (2009) added that the benefit of project is linked to time value, cost value and quality value, which must be managed to realise the desired benefits. Additionally, Xu, Zhao, Mahmoudi and Feylizadeh (2019) indicated that time, cost, and quality are considered to be critical factors to meet project objectives.

However, time, cost and scope are inadequate to assess the success of project management and should rather be considered as efficiency-based measures, and not success measures (Rahschulte & Milhauser, 2010). In the above-mentioned authors' opinion, efficiency-based measures are the actions that must be performed to deliver the project (Serrador & Turner, 2015; Muller & Jugdev, 2012; Shenhar & Dvir, 2007).

Meanwhile, there are other authors who believe that the business-value angle of a project's success should not be overlooked, given its role in profit-making and the retention of customers (Ebbesen & Hope, 2013; Shenhar & Dvir, 2007). Mills (2008) also argued that employing only the triple constraints in assessing project management success is not ideal because end-user happiness and financial success are much more important. Moreover, stakeholder satisfaction, especially that of end-users or customers, has recently been considered as a critical element in measuring project performance success (Serrador & Turner, 2015; Gemunden, 2015; Davis, 2014; Dvir *et al.*, 2003; ; De Wit, 1988; Westerveld, 2003). For instance, Turner (2009), in quoting research by Wateridge, indicated that project sponsors considered project success from the value point of view, as shown in Table 2.2. End-users view success from the functionality of the outcome, designers look at it from good design, and project managers measure success in terms of time, cost and quality.

Koelmans (2004) demonstrates the measurement of project performance based on two attributes, namely, things-related attributes and people-related attributes, as discussed below.

Things-related attributes focus on:

- Project scope; is as per requirement;
- Project quality; conformance to standard;
- Project schedule; delivery on time;
- Project cost; delivery within budget;

While **people-related attributes** consider:

- Project team morale; which entails the level of productivity, cooperation, absenteeism, and demeanour; and
- Client satisfaction: measures trust, adversarial, listening, and disclosing.

Olaf (2009) and Mantel *et al.* (2011) reiterate the relevance of the magic triangle in ensuring success. In particular, Mantel *et al.* (2011) suggest in order to properly plan, monitor and control the elements of a project, it is imperative to stay on schedule, remain within planned budgets, and ultimately meet project requirements. As a result, projects tend to be unsuccessful when an element within the magic triangle is inadequately accounted for.

Table 2.2 presents a list of the measures of success, the types of project stakeholders and the applicable timescales.

Table 2.2: Measures of success by project stakeholders

Measures of success	Types of stakeholders	Timescale
Stakeholders' value increases by the projects	Stakeholders	End of projects plus years
The project provides profit or grains	Board	End of projects plus years
Project offers desired performance improvement	Sponsor	End of projects plus years
The project outcome meets consumers' preference	Consumer	End of projects plus months
The project outcome is easy to use	Users	End of projects plus months
The project is delivered on time, budget, and with the desired quality	All stakeholders	End of projects
The project team gains satisfaction from delivering the projects	Project Team	End of projects
The contractors gain from the project	Contractors	End of projects

Source: Turner (2009)

Notwithstanding the discussions above, Turner (2009) is of the opinion that every organisation must define its set of project success criteria to ensure streamlining of activities among stakeholders. The elements in the triple constraint theory, namely, project cost performance, project time performance, and project scope performance are further explained in detail.

2.5.1 Project cost performance

Nicholas and Steyn (2012) define project costs as the total budget approved to deliver a project at a given point in time. Cost estimates enable managers to control cost expenditure, while assisting the measuring of a project's visibility (Turner, 2009). Delivery projects within the contractually agreed cost is one of the criteria for measuring construction projects performance (Durdyev *et al*., 2017). Essentially, this provides clarity on how much funding is required to complete a project, and where necessary, provides a blueprint by which additional funds can be procured. Project costs, when properly estimated, ensure the efficient allocation of resources within the duration for which projects are expected to run (Turner, 2009).

Cost estimation of projects may include (but is not limited to) labour cost, materials, plant and equipment costs, subcontractor costs, management, overhead, and administration cost, fees and taxation, inflation, and contingencies. There are four ways of estimating costs:

- Proposal estimate: this is put together at the concept stage in order to utilise resources for the project's feasibility of being done.
- Budget estimate: this is prepared whilst project feasibility is being carried out to initiate the project and utilise resources to design.
- Sanction estimate: is done during design stage to obtain funding for the project or approval from the project sponsor.
- Control estimate: this carried out during project implementation planning.

There are many tools and techniques that are used to control project costs. They include earned value management, reserve analysis, forecasting and performance reviews. Nevertheless, from the reviewed literature, overrun has been a major contributor to project value leaks. Therefore, the need for this study to ascertain the factors that have the potential to cause such value leaks, and to determine their origin to mitigate their impacts on project management performance in the telecommunication industry in Ghana.

This is followed by another important value leaks causal element known as project schedule performance, as elaborated on in the following section.

2.5.2 Project schedule performance

Time schedule is a classification of dates against which a project is tracked. The rationale for project scheduling is to justify project expenditure, coordinate and prioritise resource mobilisation, as well as their availability, and meet project deadlines (Turner, 2009; Venter 2005). The project schedule performance encompasses the process of management and timely delivery of projects to mitigate overruns on project budgets. This includes defining the scope and sequence of project activities, estimating activity resources and duration, as well as developing control schedules. The controlling project schedules also makes use of techniques, such as leads and lags, scheduling tools and modelling techniques to ensure successful monitoring (PMI, 2008).

Project time can be defined as the length of time or total duration required to deliver the project outcome. Turner (2009) outlined four steps to control project schedule: set measures, record progress, calculate the variance and take remedial action, as illustrated in Figure 2.4.

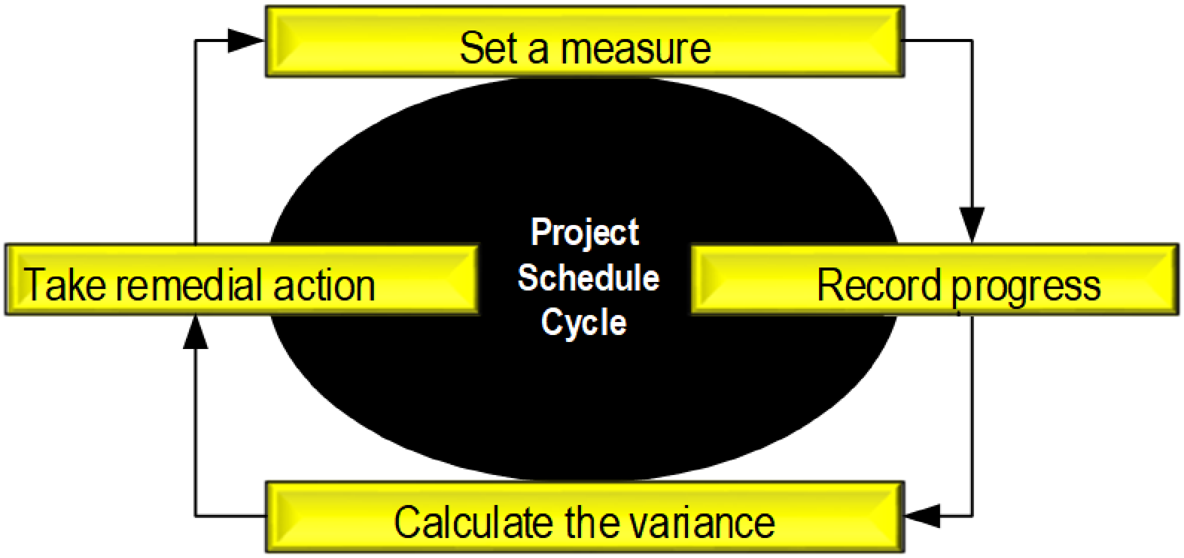


Figure 2.4: Project schedule cycle

Source: Adapted from Turner (2009)

As indicated by Mantel *et al.* (2011) and Turner (2009), one key measuring criteria of project management performance success is the ability to deliver the project on time. However, there are other contributing factors which stall the progress of projects. As a follow up to the project schedule performance, another parameter of the triple constraints is the project scope performance which is discussed below.

2.5.3 Project scope performance

The project scope comprises a well-defined list of the activities to be performed in delivering the expected results of the project (PMI, 2017). A project's scope reflects the exact expected outcome of a project. It is usually defined by the project manager and the customer. The scope also describes the expectation of the customer once the project is completed (Olaf, 2009). The scope of a project is progressively elaborated on throughout the project life cycle. Its processes include: gathering project requirements, definition of the project boundary, as well as breaking down of the work structure (PMI, 2013).

Olaf (2009) also added that project scope entails the set of deliverables expected to be delivered within the time constraints, through risks and with limited resources. The management of a project's scope requires continuous progress monitoring, cross-checking with the project plan, and taking corrective action to bring progress into agreement with the plan where necessary (Mantel *et al.*, 2011).

Mantel *et al.* (2011) outline the contributing factors to not meeting project requirements as follows:

- Project timeliness are often too unrealistic;
- Project scope encounters too many changes;
- The required key resources and data are often unavailable; and
- Unrealistic budget leading to overrun.

In addition, Olaf (2009) posits that the lack of clarity in a project's scope leads to scope creep, this entails not gaining project support, not meeting and satisfying customer needs, and eventually the inability to close the project. The techniques used to control scope involve EVA, and this calculates the key values for each activity: Budgeted Cost of Work Scheduled (BCWS), Actual Cost of Work Performed (ACWP) and Budgeted Cost of Work Performed (BCWP). Moreover, the project audit technique is used to monitor and control scope. Thus, SV and CV determine the cause and degree of difference between the baseline and actual performance (PMI, 2017; Olaf, 2011).

Projects tend to suffer from scope creep, making the project scope extend over time, resulting from changes to requirements, specification, and priorities (Olaf, 2009). This has the potential to result in value leaks. Therefore, the currents study sought to determine the factors that affect project scope, and to assess quantitatively how these factors impact project success, and subsequently to develop a diagnostic tool to avert their occurrences.

From the above discussion, it has been established that project performance is measured with regards to the delivery of it on schedule, within budget, to scope (meeting requirements), on quality and project team satisfaction (PMI, 2017; Mantel *et al.*, 2011; Olaf, 2009; Turner, 2009).

The technique that integrates and controls schedule, scope and cost is known as the EVA technique (Noori *et al.*, 2008; Lukas, 2008), and is discussed in the next section.

2.6 THE EVA TECHNIQUE

In the quest by many companies to enhance project performance, as established in Table 1.1, EVA is a method that incorporates scope, cost, and schedule in order to measure project performance indexes simultaneously (Bagherpour *et al.,*2020). Griffin (2013) noted that earned value is an exceptional way of ascertaining an ongoing project performance. Moreover, it serves as a tool with which project managers investigate and predict project performance. Acosta (2015) asserted that EVA reports variance and performance indices as well as predicting project costs and schedule at completion.

In addition to effective project control, good planning and appropriate project organisation are vital to measuring project performance with EVA (Pedro *et al.*, 2011). Mathpati and Wayal (2016) describe EVA as a method for performance measurement which shows the status of a project at any point in time and future occurrence of the project work. According to the authors, EVA is only an improvement over traditional accounting progress measure. Dayal (2008) and Mehedintu *et al.* (2008) support this assertion, further concurring with EVA's use as a tool in enhancing project performance analysis. Not only does EVA serve as a standard unit by which project progress is measured, it also provides valuable information on the performance of a project by integrating technical, cost, schedule and risk management (Mehedintu *et al.*, 2008).

Gershon (2013) views EVA from the view of the assistance it provides to project managers, assisting them to identify problems at the earliest stage of a project. Thus, EVA provides the avenue for managers to obtain swift feedback on which they can make corrective actions where necessary. In line with this, Noori *et al.* (2008) indicated that EVA assists project managers to appreciate how to manage the project from two different perspectives: firstly, by identifying current project performance indexes (SPI and CPI), and secondly, predicting future project performance.

Regardless of the benefits discussed above, none of these authors considered the concept of value leaks in the quest to expand EVA as part of its limitations, and this forms the basis of this study's intent. Some elements of EVA are discussed below.

2.6.1 The elements of the EVA technique

The elements of the EVA technique are adapted from the PMI (2013), as shown in Table 2.3, and graphically represented in Figure 2.5 under classification of basics, variances and indexes (DOE, 2008).

2.6.1.1 The basic elements

As conceptualised in this study, there are basic elements or reliable tracks which form the core measurement principles of EVA (DOE, 2008). They are Planned Value (PV), Earned Value (EV), Actual Cost (AC) and Budget at Completion (BAC).

- Planned Value (PV): The DOE (2008) explained PV as project work to be executed or the budgeted cost for planned project work;
- Earned Value (EV): Suresh and Ganapathy (2015) explain EV as the value of the physical work completed. The DOE (2008) state that EV is also known as the budgeted cost of DOE work performed (BCWP). The PMI (2013) also affirmed that EV is the equal sum of the planned value of work completed. Lukas (2008) explains that EV is determined by multiplying an activity budget by its progress percentage. Thus; EV = % complete x budget. Earned Value simply represents the budgeted value of the completed work and is directly related to the percentage of the activity that has been completed, or WBS element under consideration (Mehedintu *et al.*, 2008). This is illustrated in Figure 2.5.
- Actual Cost (AC): The DOE (2008) indicated that AC is also called actual cost of work performed (ACWP) and it is explained AC as the total cost incurred on the actual work performed at a given point in time.
- Budget at Completion (BAC): The PMI (2013) explained BAC as the sum of all budgets allocated for the project activities to be performed.

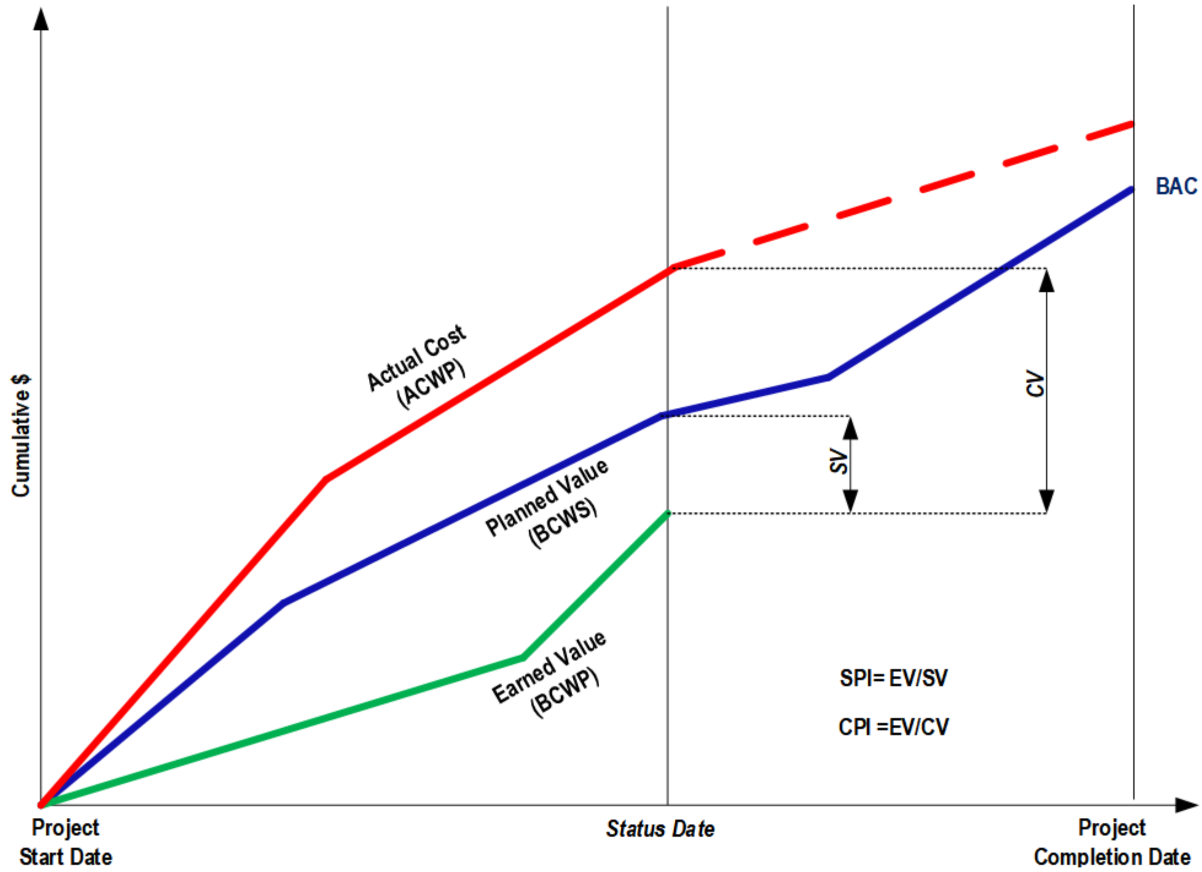


Figure 2.5: Earned Value chart

Source: Mantel & Meredith (2006)

These basic elements of EVA are used to determine cost and time performance, as well as scope performance to measure the overall performance of a project. However, the elements do not account for the measurement of project quality, making EVA as a measurement tool for value leaks, fall short. Factors like cost and time overruns constitute variance elements that must be established, as elucidated on below.

2.6.1.2 Variance elements

The variances ascertain the cost, schedule, and estimate at completion deviations from project plans, and these variances should be examined to determine the causes of the deviations, the applicable corrective action plans, and the impacts on the achievement of project success, and they should ensure that negative deviations are corrected accordingly (DOE, 2008).

- Schedule variance (SV): Vanhoucke and Vandevoorde (2006) indicate that SV provides an indication of the progress, or otherwise, of a project against its planned delivery date at any given point in time. SV is therefore determined by the difference between earned value and planned value as follows:

SV = EV-PV. Thus; Positive SV = Ahead of Schedule (Underrun); Neutral SV = On schedule and Negative SV = Behind Schedule (delays or overrun) (PMI, 2013)

- Cost variance (CV): CV is the difference between the budgeted amount to perform specific work and the actual cost incurred in performing that specific work at a given point in time. This is expressed as CV = EV-AC or BCWP-ACWP (Wyrozębski & Łysik, 2013). Therefore, CV measures the financial performance of a project. A negative CV is unfavourable, while CV of positive value is favourable (Janeska *et al.*, 2016). The PMI (2013) provides an interpretation to CV as a project operating according to planned cost when positive, and negative for a project operating above planned cost. A CV that is neutral means that the project is operating in line with the planned cost.

In addressing SV and CV, past performance against the plan should not be deleted, except to correct errors, or to enhance accuracy of project performance measurement data (DOE, 2008). The next discussion explains the indices elements which assess the project management efficiency.

2.6.1.3 Indices elements

According to the DOE (2008), indices measure the efficiency of project delivery against a project management baseline at a given point in time. The elements of these indices are Schedule Performance Index (SPI) and Cost Performance Index (CPI). When carefully monitored, these indices give accurate forecasts of future performance (DOE, 2008). However, SPI and CPI, as explained below, do not independently monitor the delivery of certain critical paths on project schedules.

- Schedule Performance Index (SPI): The PMI (2013) explains that SPI shows how effectively time is used by the project team. An SPI less than 1.0 means less work is done than expected, while more than 1.0 means more work is completed than planned. SPI = EV/SV
- Cost Performance Index (CPI): indicates how much effort is being obtained for every dollar spent (DOE, 2008). Also, the PMI (2013) indicates that CPI measures how efficiently the budget is utilised for the completed work. It is considered as the

most important metric and measure of EVA. A CPI value below 1.0 shows cost overrun for accomplished work, while above 1.0 indicates cost underrun for work done. CPI =EV/CV, as shown in Table 2.3, and Figure 2.6.

Given the relevance of the aforementioned dimensions of EVA, it is easier to determine whether a project is being delivered on time, behind time or ahead of time, as well as on, over or below the planned budget.

2.6.2 Limitations of EVA

EVA is highly endorsed and supported by the project management community within the enclave of the PMI for its value in project management measurement. In recent times, however, EVA has been subjected to immense criticism due to its limitations and implementation difficulties (Cândido, Heineck & Neto, 2014).

According to Pedro *et al.* (2011), one of EVA's limitations is the exclusion of the activities on the critical path of the project in measuring performance, some of which include the use of Gantt Charts and Critical Path Analysis. Corovic (2007) also argues that SPI in EVA is not reliable and typically deceptive over the entire life cycle of the project for the majority of commercial projects with a non-linear cumulative cost curve. Corovic (2007) explains that SPI is of no use after the planned end of the project, and therefore suggests the Earned Schedule (ES) approach as a replacement of SPI to provide reliable information on the schedule performance.

More so, understanding the concept of EVA by the project team is difficult and this makes its implementation complicated coupled with the huge cost associated with it (Bagherpour *et al.,*2020). Mahmoudi *et al.* (2019) added that EVA utilises cost as the main factor for measuring the performance of the projects, which could result in wrong results. Also, as quality of the project is not considered in measuring project performance through EVA, it does not have most suitable measures.

Additionally, Pedro *et al.* (2011) argue that WPM provides regular updates on project time and cost performance, limiting EVA's calculation to individual activities or task levels. Pedro *et al.* (2011) further added that WPM is a hybrid approach, based on work packages or activities to enhance and improve EVA.

Noori *et al.* (2008) also argued that EVA is established in the context of project management as the integration of time and cost performance within project scope, specifically in terms of the employment of SPI and CPI to show the performance of the project. However, EVA lacks a well-organised control mechanism to detect the actual situations of SPI and CPI, not only in figures, but also to categorise the earned value management system etymologically, hence, the proposal of a fuzzy control chart approach linked to α-cut to control SPI and CPI in etymology terms (Noori *et al.*, 2008).

In light of the above EVA limitations, as postulated by these researchers, one of these research works focused on the occurrence of time and cost overruns as value leaks in project management. However, to appreciate the concept of value leaks in project management, there is the need to explain project value within the context of using a project to achieve business success. Miles (2015) argues that the term 'value' is subjective, which necessitates placing it in a context to ascribe proper meaning to it, as it varies unavoidably in relation to context, individual experience, and within various enterprises. Table 2.3 presents a summary of EVA terminology.

In the next section, project value is elucidated on within the context of project management.

Table 2.3: Earned Value Analysis terminologies

EARNED VALUE ANALYSIS TABLE							
	Acronym	Full Name	Brief Descrition	How used	Formula	Interpretation of Result	Value Leaks deductions
Basics	PV	Planned Value	The approved budget allocated to scheduled work.	The value of the project work scheduled to closed at a given point in time.			
	EV	Earned Value	The value of work completed expressed in terms of the budget approved for that work.	The planned value of all the work completed (earned) in a given point in time, usually the data date, without reference to actual costs.	EV = sum of the planned value of completed work		
	AC	Actual Cost	The known cost incurred for the work carried out on an activity during at a given time period.	The actual cost of all the work completed to a point in time, usually the data date.			
	BAC	Budget at Completion	The sum of all budgets allocated for the project activities to be executed.	The value of total planned work, the project cost baseline.			
Variances	CV	Cost Variance	The amount of budget deficit or surplus at a given point in time, expressed as the difference between the earned value and the actual cost	The difference between the value of work completed at a given point in time and the actual costs at the same given point in time.	CV = EV – AC	Positive = Under planned cost Neutral = On planned cost Negative = Over planned cost	Value is leaked when AC is negative. This indicates Cost Overrun
	SV	Schedule Variance	The amount by which the project is underrun or overrun the planned delivery date, at a given point in time, expressed as the difference between the earned value and the planned value.	The difference between the work completed at given point in time, usually the data date, and the work planned to be completed to the same point in time.	SV = EV – PV	Positive = Ahead of Schedule (Underrrun) Neutral = On schedule Negative = Behind Schedule (delays or overrun)	Value is leaked when SV is negative. This shows Time Overrun
	VAC	Variance at Completion	A projection of the amount of budget deficit or surplus, expressed as the difference between the budget at completion and the estimate at completion.	The estimated difference in cost at the completion of the project.	VAC = BAC – EAC	Positive = Under planned cost Neutral = On planned cost Negative = Over planned cost	Value is leaked when VAC is negative. This indicates budget deficit (Cost Overrun)
Index	CPI	Cost Performance Index	A measure of the cost efficiency of budgeted resources expressed as the ratio of earned value to actual cost.	A CPI of 1.0 means the project is exactly on budget, that the work actually done so far is exactly the same as the cost so far. Other values show the percentage of how much costs are over or under the budgeted amount for work accomplished.	CPI = EV/AC	Greater than 1.0 = Under planned cost Exactly 1.0 = On planned cost Less than 1.0 = Over planned cost	Value is leaked when CPI is less than 1.0. This shows Cost Overrun
	SPI	Schedule Performance Index	A measure of schedule efficiency expressed as the ratio of earned value to planned value.	An SPI of 1.0 means that the project is exactly on schedule, that the work actually done so far is exactly the same as the work planned to be done so far. Other values show the percentage of how much costs are over or under the budgeted amount for work planned.	SPI = EV/PV	Greater than 1.0 = Ahead of schedule Exactly 1.0 = On schedule Less than 1.0 = Behind schedule	Value is leaked when SPI is less than 1.0. This shows delays (Time Overrun)

Source: Adapted from PMI (2013)

2.7 THE CONCEPT OF PROJECT VALUE LEAKS IN EVA

In the survey by Baratta (2006), it was argued that ascertaining project performance variances with respect to budget (CV) and schedule (SV) allows for the determination of how much value is left behind. Weaver (2012) asserted that creating value within the context of project management entails two intertwined schemes: (1) creating value on projects from ideation to value realisation, and (2) processes to effectively manage project management infrastructure of the organisation. Thus, value leaks are viewed within the context of project management and not in its aftermath (Too & Weaver, 2014; Jenner, 2012; Zhai *et al.*, 2009). The PMI (2008) illustrates the interaction among these variables of EVA technique (PV, AC, EV, CV, SV, SPI & CPI) as shown in Figure 2.6.

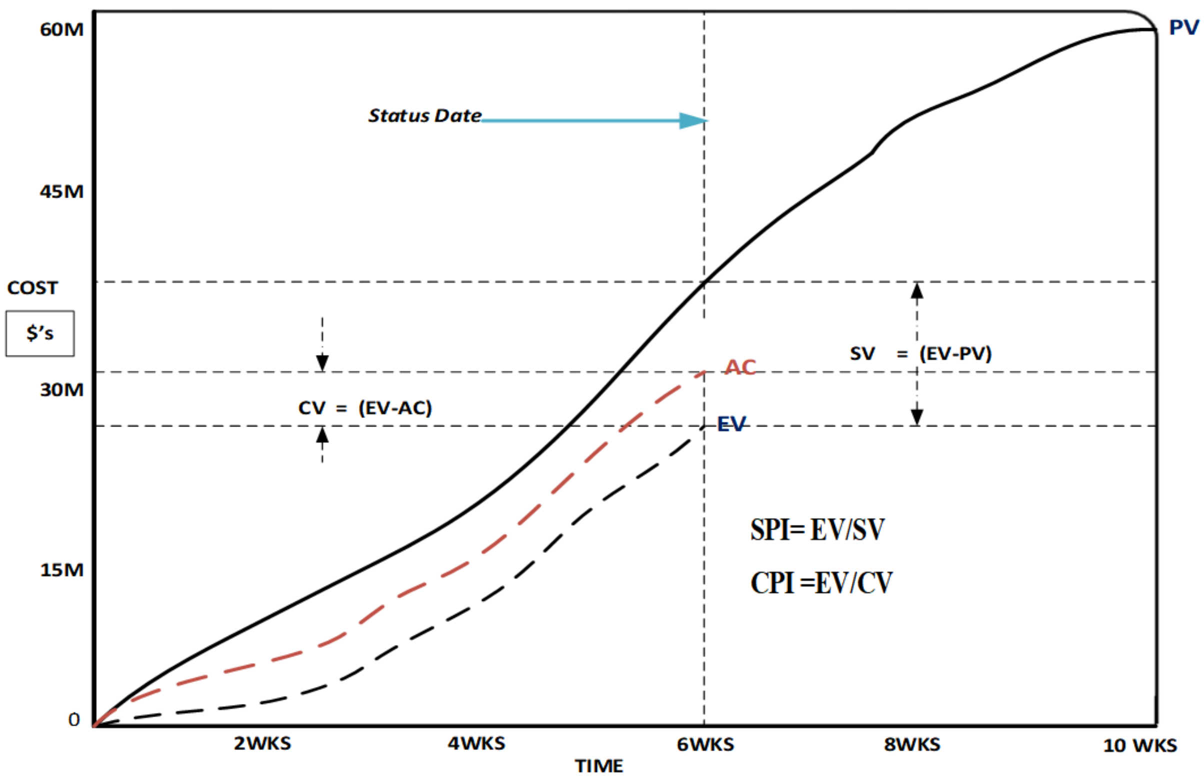


Figure 2.6: The interaction among PV, AC and EV

Source: Adapted from PMBOK® Guide (2008)

In this description of variances, Griffiths (2006) explains that when Cost variance (CV) is negative, the budget allocated for the performance of that work has been overspent. Likewise, when Schedule variance, (SV) is negative, the work expected to be completed at a given point in time is delayed. Moreover, with respect to indices, the

PMI (2013) explains that when CPI is less than one (1), then the project work is over the planned budget, and when the SPI is less than one (1), then also the project work is behind schedule.

Owing to this, it can be concluded that value leaks within the context of managing a project is considered as an occurrence of time and cost overruns. However, EVA does not take into account omissions and additions to project requirements (not meeting requirement), and defects in project deliverables, as well as rework in project works (poor quality or unfit for purpose).

Moreover, when SPI and CPI are below 1.0, the project team is ineffective with activities' timeliness, and they are inefficient in budget utilisation (Project Team dissatisfaction) (Pedro *et al.*, 2011; Pennypacker, 2005; Howes, 2000; CBP, 2000; General Accounting Office, 1996).

Therefore, for the purpose of this study, value leak is considered as an occurrence of time overrun, cost overruns, poor quality, not meeting requirements and project team dissatisfaction, known as value leaks measures within the context of managing a project.

2.7.1 Value leaks measures and their causal factors

As illustrated in Figure 1.1 in Chapter 1, the value leaks measures are formulated from both project performance measures and project value measures, as parameters to determine the occurrence of project value that goes unrealised during implementation. These measures are time overrun, cost overrun, out of scope, poor quality and project team dissatisfaction.

Due to limited research within the context of the telecommunication industry, this study draws a great deal of information from the construction industry, since network expansion projects within the telecommunication industry take the same shape as that of the construction industry (Ameh *et al.*, 2010). This is because some of the overruns' causal factors in the construction sector could impact that of telecommunication projects (Ameh *et al.*, 2010). However, EVA as an accepted technique to measure project performance, only employs time, scope and cost elements in assessing project performance, and excludes other relevant parameters, as previously mentioned. Griffin (2013) affirmed in his study "The value earned with earned value" that one of the limitations of earned value is lack of reasons for the overruns' existence and how to mitigate them. As earned value does not give the project manager any indication of the factors that contributed to such variances, and merely suggests that incorrect estimates, scope creep, unexpected difficulties, among others are the factors for investigation.

Griffin (2013) therefore concluded that the project manager should make efforts to identify the causes of these value leaks (variances) and remedy them. Hence, there is the need to investigate these causal factors, sources, and their impact on project performance within the context of telecommunication projects. Below are brief explanations of the value leaks parameters.

2.7.1.1 Project budget overrun (cost overrun)

According to research by Love *et al.* (2013), cost overrun is a rise in the cost resulting from an increase in the project budget. Ismail (2014) also defined cost overrun as an increase in project cost as against its allocated budget. Danso and Antwi (2012) defined cost overrun in their study as the cost difference in budget at completion and planned budget for the project. For their part, Ameh *et al.* (2010) argued that cost overrun expressed in percentage is the ration of the cost overrun and the budget at completion multiply by hundred. The excess in a planned budget of any project activity could compromise financial performance of a project stakeholder (Huo *et al*., 2018).

Amid these research works, none of them considered the occurrence of cost overrun as a measure of value leaks. For the purpose of this study, cost overrun is a measure of project value leaks and can be defined as the extra cost incurred, besides the project's initial budget, to be able to deliver project outcome. Thus, the additional budget needed to complete the project due to overspending of the initial project budget. This overspending is the value gone unrealised (value leaks) due to various factors.

With respect to the causal factors, a study by Rauzana (2016) into cost overruns and failures in construction projects revealed that factors such as poor cost estimates, poor stakeholder coordination and communication, and inexperienced contractors are the major factors of cost overruns in construction projects. In support of this, Rahman *et al.*'s (2013) study into factors of cost overrun, found factors such as fluctuation of prices of material, cash flow and financial difficulties faced by the contractor, poor site management and supervision, lack of experience, schedule delay, inadequate planning and scheduling, incompetent subcontractors, and mistakes and errors in design, to be some factors contributing to project cost overruns. Additionally, the Department of Energy (DOE, 2008) indicated price increases, rates changes (labour, overhead), material cost changes and requirement changes to be among the key factors to cause cost variance during project management. Other cost overruns factors identified are poor communication, inaccurate estimations, stakeholder skills, poor financial management (Durdyev, 2020; Mahamid, 2018; Famiyeh *et al*., 2017; Kim *et al.,* 2017).

That notwithstanding, within the context of telecommunication industry in Ghana, less or no research work has established that some of these factors are value leaks' causal factors in the network expansion projects within the industry, so it is of importance to establish that fact through this study. This is followed by the discussion of another value leaks' causal factor, termed as project schedule overrun.

2.7.1.2 Project schedule overrun (time overrun)

According to Ismail (2014), time overrun is the late delivery of work activities against their originally planned duration. Pai and Bharath (2013) also argued that time overrun can be described as a project being delivered at a slower pace than expected. In addition, Ameh *et al.* (2010) defined time overrun as the time variance between the actual and planned date of the project. From these definitions, the occurrence of time overrun is considered as a project value leak, and no research work has situated it as a measure of project value leaks.

Therefore, for the purpose of this study, time overrun is a measure of project value leaks which is believed to have been caused by some factors and is defined as the difference between the expected delivery date and actual delivery date of the project.

A study by Bentil *et al.* (2017) on the level of existing time overruns in the construction industry in Ghana identified the top 10 factors that contribute to schedule overruns, namely: delays in payment; issues of project funds; fluctuation of prices of materials; late delivery of materials; high inflation and interest rates; poor contract management; changes in project scope; poor supervision and site management; and inaccurate time and cost estimates. In addition, the DOE (2008) listed aspects, such as poor project scheduling (inaccurate time estimate), insufficient resources, the non-availability of experienced contractor/subcontractor/vendor, labour disputes/work stoppage, requirement changes, as some of the causal factors of time overruns in project management.

From observation, no study has ascertained these abovementioned factors within the telecommunication industry as the causal factors of value leaks, either in relation to telecommunication projects at large, or specifically, network expansion projects within the telecommunication industry. Consequently, there is the need to determine such factors and their impact on network expansion projects within this industry in Ghana.

2.7.1.3 Overruns (cost and time) causal factors

In the context of the telecommunication industry, a few research works have been found on overruns, where time and cost are combined. This includes a study by Al Zadjali *et al.* (2014) that investigated the causal factors for overruns in a telecommunication project in Oman. The above study revealed factors, such as inaccurate time and cost estimates, indecisiveness of project participants, lack of top management support, and poor cost estimates as causal factors for overruns.

Danso and Antwi (2012) from Ghana, investigated tower projects (cell site rollout projects) executed by Tigo (one of the five mobile network operators in Ghana) from 1992 to 2011. They found that the factors that cause time and cost overruns in telecommunication tower construction in Ghana include poor site management and supervision, poor contract management, poor deliverables quality, incorrect requirements, lack of understanding for end-user requirements, and delays in payment.

It can be inferred that these factors mainly emanate from the project stakeholders, such as clients delaying payment certificates, and poor site management, and the project environment, like government policies and requirement needs. However, the researchers attributed all the factors to client-related, contractor-related, as well as consultant-related, which are all forms of project stakeholders. In addition, the researcher focused only on time and cost overruns without investigating factors, such as poor quality, unmet project requirement, and project team dissatisfaction. Furthermore, they failed to quantify the impact on project performance and to establish that some of these factors stem from other sources such as the project environment and project life cycle.

Ameh *et al.* (2010) conducted a study into significant factors causing cost overruns in telecommunication projects in Nigeria, and found factors such as the unstable organisational environment, fluctuation of prices of materials, mistakes and errors in design, hostile social economic and climatic condition, and the non-availability of experienced contractor as factors. However, Ameh *et al.* (2010) did not develop a diagnostic tool to curb the occurrences of these factors, quantify the impact of these factors on project performance, and view these factors from project stakeholders in totality, as well as project life cycle, in addition to the environmental classification.

With respect to the limited research within the context of telecommunication industry, this current study borrowed information from the construction industry, since network expansion projects within the telecommunication industry take the same shape as that of the construction industry (Ameh *et al.*, 2010).

In line with this, several research works have been identified that focused on the construction industry's perspective on the factors believed to cause time and cost overruns, which are just two elements of value leaks' causal factors. These researchers include Bentil *et al.* (2017) in Ghana; Rauzana (2016) in Indonesia; Hasan *et al.* (2014) in Bahrain; Memon *et al.* (2014) in Malaysia; Murray and Seif (2013) in Nigeria; Marzouk and El-Rasas (2014) in Egypt; Alinaitwe *et al.* (2013) in Uganda, and Sweis (2013) in Jordan., as summarised in Table 2.5.

They above scholars identified some common factors that generally cause project time and cost overruns that result in value leaks in the construction industry. For instance, Bentil *et al.* (2017) conducted research into the level of occurrence and the impact of cost and time overruns of construction projects in Ghana, and found value leaks factors, which include gold plating or over-specification, late delivery of materials, inaccurate time and cost estimates, labour disputes, and so forth.

For her part, Rauzana's (2016) research into the failure of construction projects in Indonesia found high inflation and interest rates, changes in project scope, poor client-vendor relationship, conflict among project participants, poor supervision and inspections, and project manager's incompetence as causal factors. Murray and Seif's (2013) research produced factors such as poor communication, poor site management and supervision, inaccurate time and cost estimates, as causing value leaks in Nigeria's construction industry.

Alinaitwe *et al.* (2013) found factors which include the late delivery of materials, inexperienced contractors, and ill-defined project scope, as overruns' causal factors in the construction industry in Uganda. Newton (2015) outlined some factors to cause value leaks which include gold plating or over-specification, poor deliverable quality, and not achieving apprehended requirements.

2.7.1.4 Out of scope of work (not meeting project scope of work)

According to the PMI (2017), requirements cover conditions or capabilities that are needed to be part of a product, service, or result to satisfy an agreement or other formally levied specification. Therefore, project requirements are compared to the actual results to detect any deviation in the agreed-upon scope for the project product (PMI, 2017). When the outcome or deliverables of the project do not meet project expectation, then there is an occurrence of unmet project requirements, constituting value leaks, as there is the need to effect change, corrective action, or preventive action to meet the expected project requirement (PMI, 2017; Desmond, 2004; Smith, 2007). Effecting such change or corrective action impacts the project cost (budget), time (schedule), and quality, resulting in overruns because project requirements lay the basis for the determination of these parameters (PMI, 2017).

Nevertheless, no research work has situated the unmet project requirements as a measure of value leaks in project management, hence, the need for this current study.

In light of this, Westland (2006) indicated that among the reasons why project deliverables do not meet requirement include undefined project requirements, scope creep, and poor deliverable quality. The PMI (2017) added that the uncontrolled expansion to product or project scope, without modifications to the estimates of time, cost, and resources, is known as scope creep.

Taherdoost and Keshavarzsaleh (2016) outlined some factors which cause projects to not meet their requirement. These factors are conflicting requirements, gold plating or over-specification, ill-defined project scope, incorrect, unclear or inadequate requirements, and not based on sound business case. Factors such as poor scoping, incomplete and error in project requirements, among other factors, are found to cause unmet project requirements within the construction industry (Bentil *et al.*, 2017; Rauzana, 2016; Ade-Ojo & Bababliola, 2013).

Although the factors discussed above have been identified as preventing projects from meeting their scope within the construction industry, such a finding has not been done within the context of network projects in the telecommunication industry in Ghana, hence, this study. The next parameter of value leaks in poor project quality is discussed below.

2.7.1.5 Poor project quality

According to Vrincut (2014), the quality of a project can be explained as the extent by which a set of properties of the project outcome meets the standards that were predetermined prior to the project implementation. The term 'fit for purpose' is when the launch of the project outcome or product/service solves the problem identified for the basis of project adoption, or exploits the opportunities intended (Turner, 2009). Jha and Iyer (2006) hold that quality meets the customer's expectations or specifications.

The cost incurred by ensuring that the project outcome meets its purpose is called 'cost of conformance' (Newton, 2015). The cost of conformance includes prevention costs (build of a quality product) and appraisal costs (assessing the product) (Newton, 2015) as shown in Figure 2.7. However, when the outcome of a project does not meet its purpose, it is considered as 'poor quality' or 'unfit for purpose', resulting in value leaks in project management (Newton, 2015; Verzuh, 2004). The PMI (2017) states that when the features of a project do not meet specifications, defect repair or rework may be requested.

It can be deduced that this poor quality, or non-conformance, constitutes value leaks, as additional budget is required to gain acceptance of the project outcome. Nevertheless, no research work has considered this as a measure of value leaks in project management. Furthermore, due to quality failures, the cost of non-conformance (which covers the cost of rework or scrap) would be incurred during and after the project to correct the quality issues, as shown in Figure 2.7 (Newton, 2015).

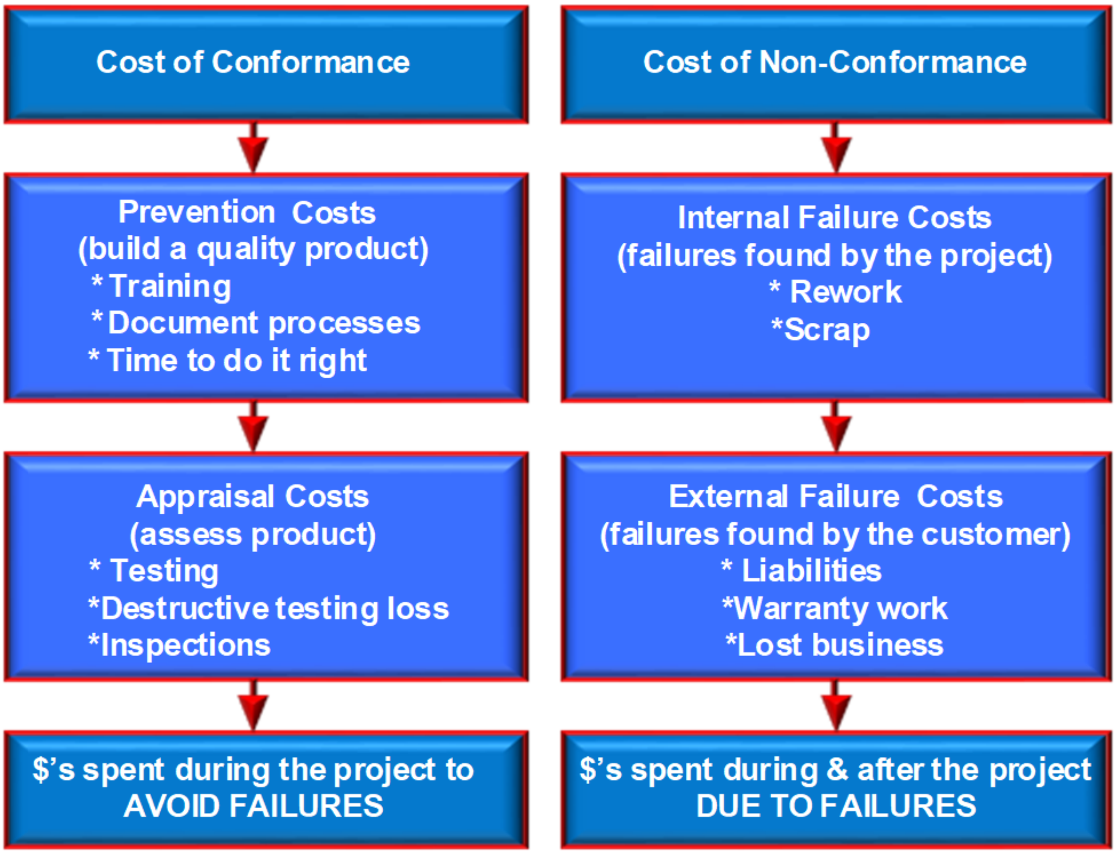


Figure 2.7: The costs of quality

Source: Newton (2015)

As seen in Figure 2.7, the cost of conformance involves the prevention and appraisal costs incurred in conforming to these predetermined standards (for example, training, equipment, additional time, testing and inspections). The cost of non-conformance entails the internal and external costs that would have been incurred if this quality standard was not achieved. These costs involve reworking or scrapping failed parts (internal costs) and the costs linked to sending out parts that were unacceptable to the customer (Newton, 2015).

In light of the poor quality causal factors, Newton (2015) outlined some activities that result in poor quality during project management, as listed below:

- Insufficient information taken from end-users;
- Not asking all user groups for input;
- Lack of understanding of requirements;
- Not achieving apprehended requirements;
- Changing quality needs during project implementation; and

- Exceeding quality requirements for the project.

a. Research on poor quality (quality issues)

Little recent research work has been conducted on project quality issues, although none of them have considered poor quality as a measure of unrealised project value (value leaks). Among previous research on project quality, notable ones include:

- Barber *et al.* (2000): their study assessed the cost of quality failure of a two highway projects-based Design–Build–Finance–Operate contractual model. They found that the cost of quality failure of contract value was 16% and 23%, which resulted from the cost of delay.
- Josephson and Hammarlund (1999): the authors assessed the defect costs of seven building projects and found defect occurrence of 283 to 480 emanating from the project life cycle. Essentially 32% of defect costs came from the design stage (design team), 45% resulted from on-site (site management/ subcontractors) and 20% from materials, plant and equipment.
- Love (2002): the author sampled 161 projects and revealed direct rework costs of 6.4%, as well as indirect costs of 5.6%.

Table 2.4 summarises the research on poor quality conducted by Love and Edwards (2004). This involves the researchers' country and the type of the quality issue, as well as their findings as elaborated above.

This is followed by a discussion on rework emanating from poor quality issues.

Table 2.4: Synopsis of research work on quality issue

Author	Country	Type of quality issue	Purpose
Barber *et al.* (2000)	UK	Quality failure	The study assessed cost of quality failure of two highway projects based on the Design-Build-Finance-Operate contractual model. It was found that the cost of quality failure of contract value was 16% and 23%, which resulted from the cost of delays.
Abdul-Rahman (1993)	UK	Non-conformance	It was found that an estimated cost of non-conformance of a water treatment plant project identified 62 non-conformance items, constituting 6% of project cost. In a highway project, 72 non-conformance items were identified resulting from the subcontractor, construction and design-related issues.
Josephson and Hammarlund (1999)	Sweden	Defects	This study assessed the defect costs of seven building projects and found defect occurrences numbering 283 to 480 that emanated from the project life cycle. Thus; 32% of the defect costs came from the design stage (design team), 45% resulted from on-site (site management/subcontractors) and 20% from materials, plant and equipment.
Nyle 'n (1996)	Sweden	Quality failure	This research looked into the quality failure costs in four major railway-engineering projects, and found 232 failures at the project implementation phase, constituting 10%, which is attributed to 90% of failure costs. 51% of this failure stemmed from the design, due to communication problems between client and consultants.
Love (2002)	Australia	Rework	The study sampled 161 projects, and revealed direct reworks costs of 6.4%, as well as indirect costs of 5.6%.

Source: Love & Edwards (2004)

b. Rework

Love (2002) explains rework as the needless effort of re-doing a process or activity that is wrongly executed the first time. Rework is considered a contributing factor to cost and schedule overruns, thus; value leaks on a project. Love and Edwards (2004) concluded in their survey that project rework does not only contribute to cost and schedule overruns but impact adversely on intra-and inter-organisational relations as well as emotional well-being of individuals such as dissatisfactions, stress etc. In their survey, the authors included lack of understanding for end-user requirement; poor contract documentation and low consultant fees; poor standard of workmanship; lack of quality focus; poor supervision and inspections.

Jha and Iyer's (2006) research into the underperformance of the quality of Indian construction projects resulted in Figure 2.8, as seen below.

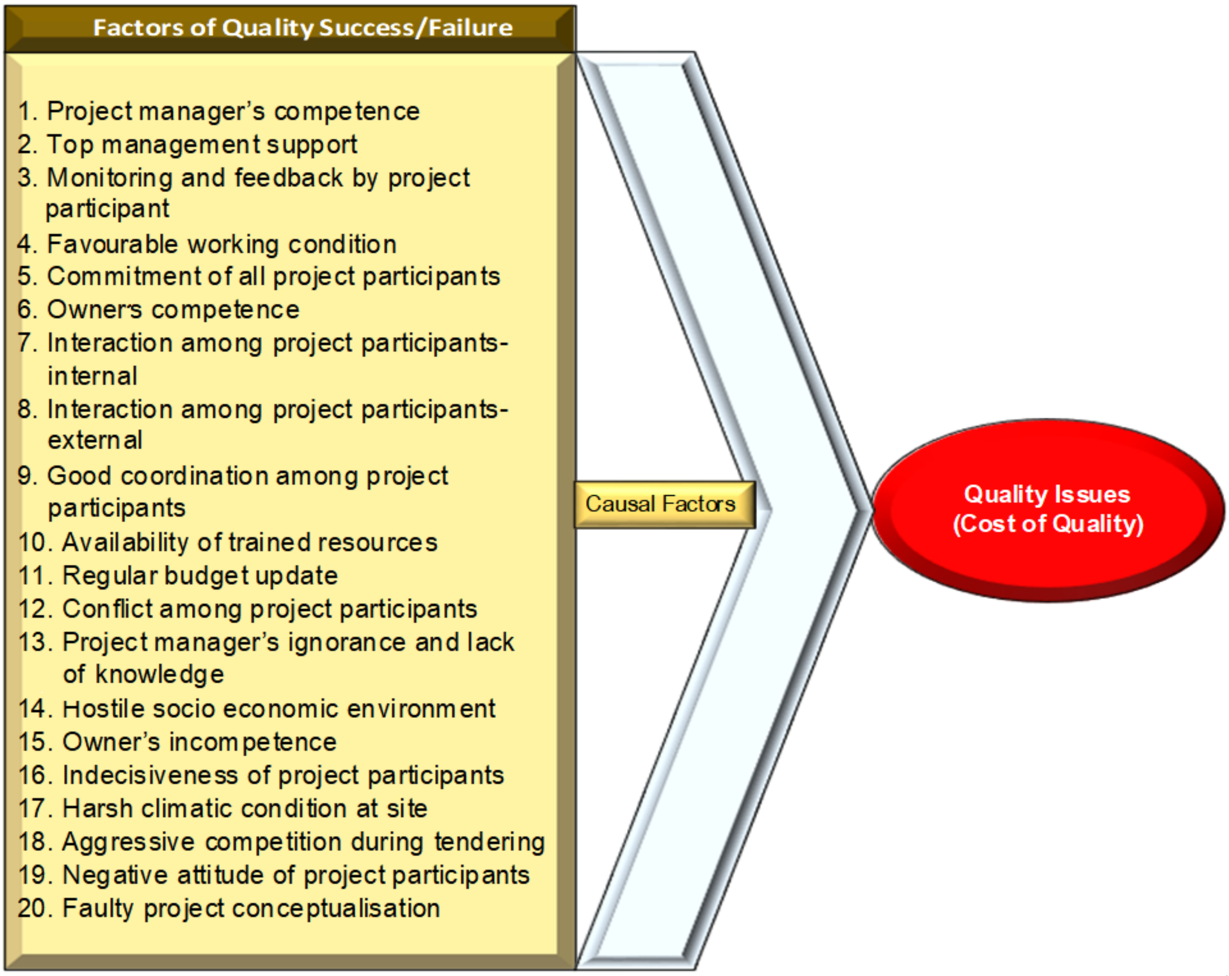


Figure 2.8: Factors of poor quality

Source: Adapted from Jha & Iyer (2006)

As seen in Figure 2.8, Jha and Iyer (2006) conducted research into the reasons for the underperformance of the quality of Indian construction projects. Their research revealed that factors such as conflict among project participants, hostile socio-economic and climatic conditions, project manager's ignorance and lack of knowledge, faulty project conceptualisation, project-specific factors, and aggressive competition during tendering led to poor project quality.

According to Love and Edwards (2004), the factors that help to mitigate project reworks include: understanding and identifying client and end-user requirement and implementing techniques for mitigating change; auditing contract documentation and providing a risk assessment for the potential of change and errors; implementing quality management practices; implementing training programmes to enhance skills and knowledge, and the use of the last planner approach during the production planning process.

As already established, quality is excluded from EVA in measuring project performance. Besides, no research work has ascertained that these identified factors of poor quality in the construction industry could also cause poor quality that results in value leaks in network expansion projects in the telecommunication industry. This study therefore intends to establish that within the context of the telecommunication industry in Ghana.

The last parameter of value leaks is project team dissatisfaction, as discussed below.

2.7.1.6 Project team dissatisfaction

According to the PMI (2017), project teams are motivated when they are rewarded for their perceived value. A project team whose members are dissatisfied tend to be unproductive. The ability of a project to accomplish its deliverables, while reducing costs and schedules largely depends on the skills and commitment of the project team (PMI, 2017). Essentially, a demoralised team becomes unproductive, resulting in project elements, such as budgets, schedules and quality, not being appropriated at their best. This can potentially lead to the occurrence of value leaks (PMI, 2013; Mantel *et al.*, 2011; Smith, 2007; Pennypacker, 2005; CBP, 2000).

The PMI (2017) further suggests the morale of a project team can be raised by establishing agreement and feelings of trust among team members to enhance teamwork. Project managers can accomplish team satisfaction by rewarding project members throughout the project life cycle, and not necessarily only at the stage of project delivery. Moreover, a lack of management and technical skills, and poor negotiation, conflict and communication skills, result in project failure, and can impact on the satisfaction of project teams. Therefore, it is imperative that the competencies of project teams are enhanced through training and mentoring.

Taherdoost and Keshavarzsaleh (2016) outline the factors that cause project team dissatisfaction. These factors include changes in organisational management and leadership; negative effects of corporate politics; unsupportive organisational culture; different geographical locations; lack of top management support; poor client-vendor relationship; and unstable organisational environment.

Despite the best efforts of the researcher in the current study, no research work that investigated the causal factors of other parameters of value leaks, as aforementioned, could be found. Similarly, no studies could be found that have determined that these factors could result in project team dissatisfaction in network expansion projects in the telecommunication industry leading to value leaks, hence, this study.

To give more clarity on value leaks, the following section discusses some common occurrences of value leaks.

2.7.2 Typical examples of value leaks in EVA calculation

According to Griffin (2013), a *CPI of 0.75* can be explained as the value of US$ 0.75 earned for every dollar spent. Thus, it begets the question of what happened to the remaining US$0.25 that ought to have been realised? Griffin (2013) suggests that the remaining US$0.25 is the unrealised value that should have been earned; that is, the value leaked from the full expected value that was achieved (see Figure 2.9).

In a similar study by Pedro *et al.* (2011), the authors applied the same analogy in explaining a *CPI of 0.9*; that is for every US$1 spent on the project, the value earned is 90 cents for performing that planned activity at any given point in time. Thus, from every $1 spent, 10 cents goes unrealised in terms of earned value. Also, Moselhi *et al.* (2011) cited that an *SPI of 0.57* indicates that the project is progressing at 57% of the rate originally planned. In effect, this suggests a delay in the completion of the project work at that given point in time (see Figure 2.9).

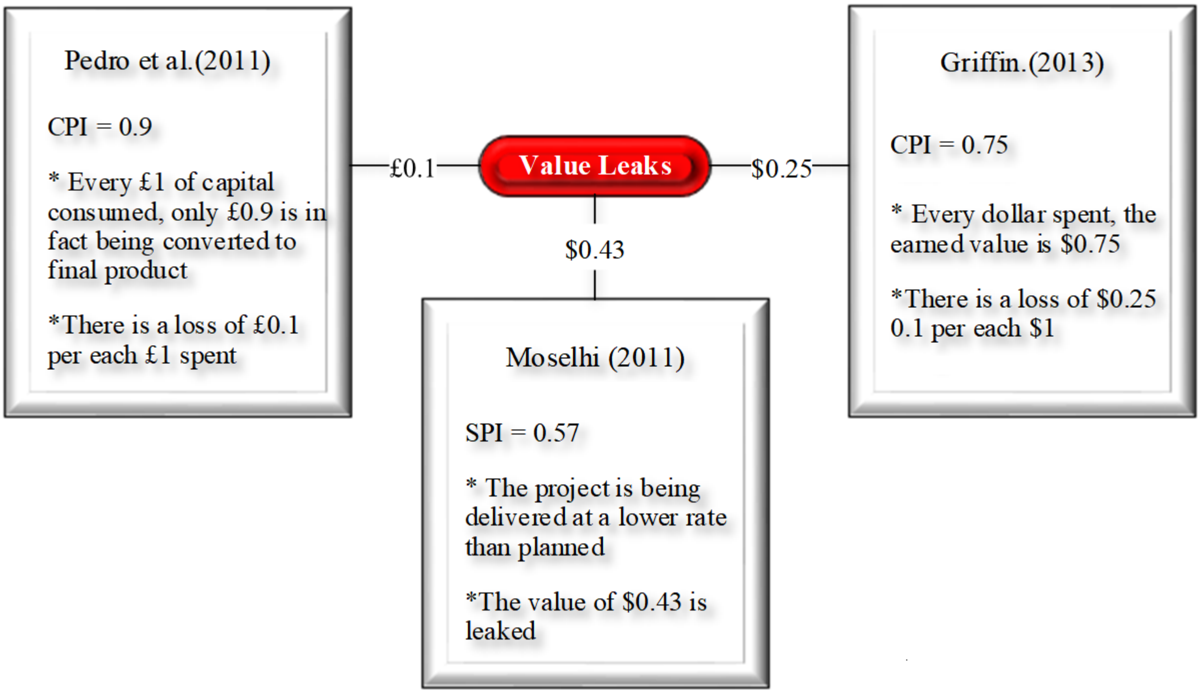


Figure 2.9: Typical examples of value leaks' occurrence

Source: Researcher's own compilation (2019)

In addition, Lukas (2008) illustrated the EVA's ability to assess a project's predisposition to danger in terms of time and cost overruns, as seen in Figure 2.10.

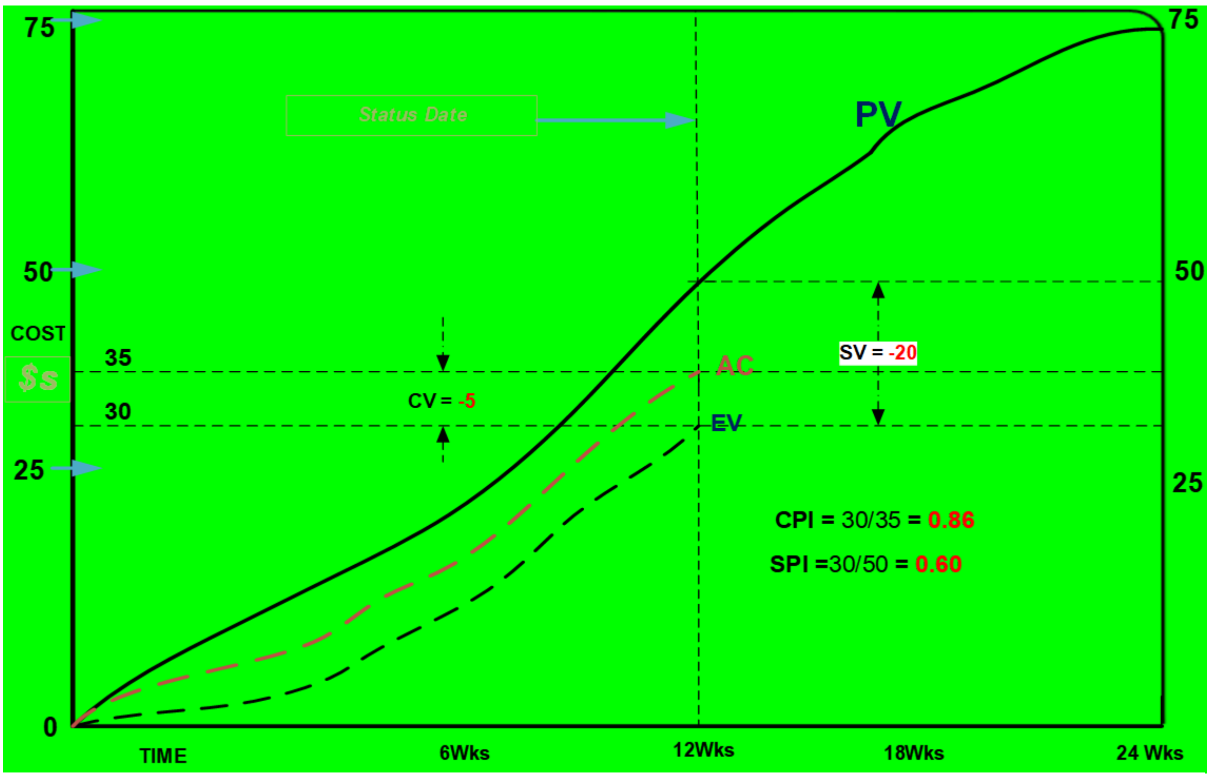


Figure 2.10: Earned value analysis indication of value leaks' occurrence in a project

Source: Lukas (2009)

Figure 2.10 shows the following: cost variance (CV) is $5, schedule variance (SV) is $20, and actual value of work earned is $30. However, per the project schedule, $50 of project work was expected to have been accomplished, therefore, the project is behind schedule of $20. Moreover, with a budget of $30, the actual cost of the work accomplished was $35, thus inferring the occurrence of a cost overrun of $5.

From Lukas' (2008) illustrations, it can be argued that time overrun of $20 and cost overrun of $5 are the value leaks because these amounts were not realised in the project performance. Also, it is evident from Figure 2.10 that CPI is 0.86 and SPI is 0.60, which indicates the occurrence of cost overrun and time overrun, respectively. Deductively, delivery project work is behind schedule and overspending of its budget may lead to value leaks.

Albeit, EVA does not consider such occurrences as value leaks in its project performance measures, and no study has established that. The next section discusses the sources of value leaks.

2.8 SOURCES OF PROJECT VALUE LEAKS IN THE TELECOMMUNICATION INDUSTRY

Desmond's (2004) work indicated that the project environment, project stakeholders, and the process for project implementation form some of the common sources of project risks (time and cost overruns). In view of this, there are individuals who have the ability to influence the delivery of the project or are impacted by the outcome of the project. They are referred to as the project stakeholders (PMI, 2017; Ludovico & Petrarca, 2010; Sherif, 2006). However, there are factors from the environment within which a project is implemented that can influence its outcome (PMI, 2013, 2017; Ludovico & Petrarca, 2010).

The projects in the telecommunication industry go through a series of phases known as project life cycle before delivering the project value (PMI, 2017; Turner, 2009). In view of this, the below sub-sections provide detailed explanations of the project stakeholders, the project environment and project life cycle as sources of projects value leaks' factors.

2.8.1 Project stakeholders

The PMI (2017) identifies a project stakeholder as an individual who is impacted by the decisions, activities, and outcome of a project. A study by Love *et al.* (2016) into cost overruns in transportation infrastructure projects emphasised the theory of causation. The study advocated for two schools of thought, namely, evolution theorists and psycho strategists in terms of the occurrence of overruns.

The evolution theorists share the view that changes to the scope of work after the initial planning brings about overruns. However, the psycho strategists share the opinion that dishonesty and bias in planning the project from its inception result in overruns. Judging from this assertion, it can be contended that a project stakeholder is a source of value leaks, as the occurrence of overruns constitutes value leaks and the behavioural nature of the project team can result in overruns, out of scope, poor quality and dissatisfaction.

In addition, Sherif (2006) asserted that the multidisciplinary make-up of projects requires various stakeholders to see to their delivery. For example, projects entail many engineering facets (like construction, physical design, mechanical and electrical) in addition to the commercial functions of sales, procurement, supply chain, marketing, and legal components. This is similar to projects in the telecommunication industry that have cross-functional coordination and activities. With regards to this, Ludovico and Petrarca (2010) indicated that stakeholders in the telecommunication industry can influence the ability to deliver telecommunication projects successfully. They listed functional managers, staff, sponsors, initiators, delivery managers, internal marketing, end-users, competitors, government agencies, third parties and vendors, as possible project stakeholders.

Furthermore, Westland (2006) suggests that for a project to run effectively, it requires the appropriate competencies and skills from its stakeholders. Deficient projects have often resulted from poor leadership or lack of the needed technical support. Such projects have encountered deviations in project budget and schedule which have potentially impacted the full realisation of the expected project value (Veronika, Riantini & Trigunarsyah, 2006).

Griffin (2013), therefore, concludes that it is the duty of project managers to ensure that projects are well resourced to enable them to function properly. It is also imperative that they are able to deduce these variances or leaks in project implementation, and devise ways to remedy them. Essentially, the power and interest of these project stakeholders (see Figure 2.11) ultimately determine whether a project will succeed or not (PMI, 2013). On this account, project stakeholders can be considered as a source of value leaks, as their influence can cause failure.

Figure 2.11 provides a graphical illustration of the range of project stakeholders.

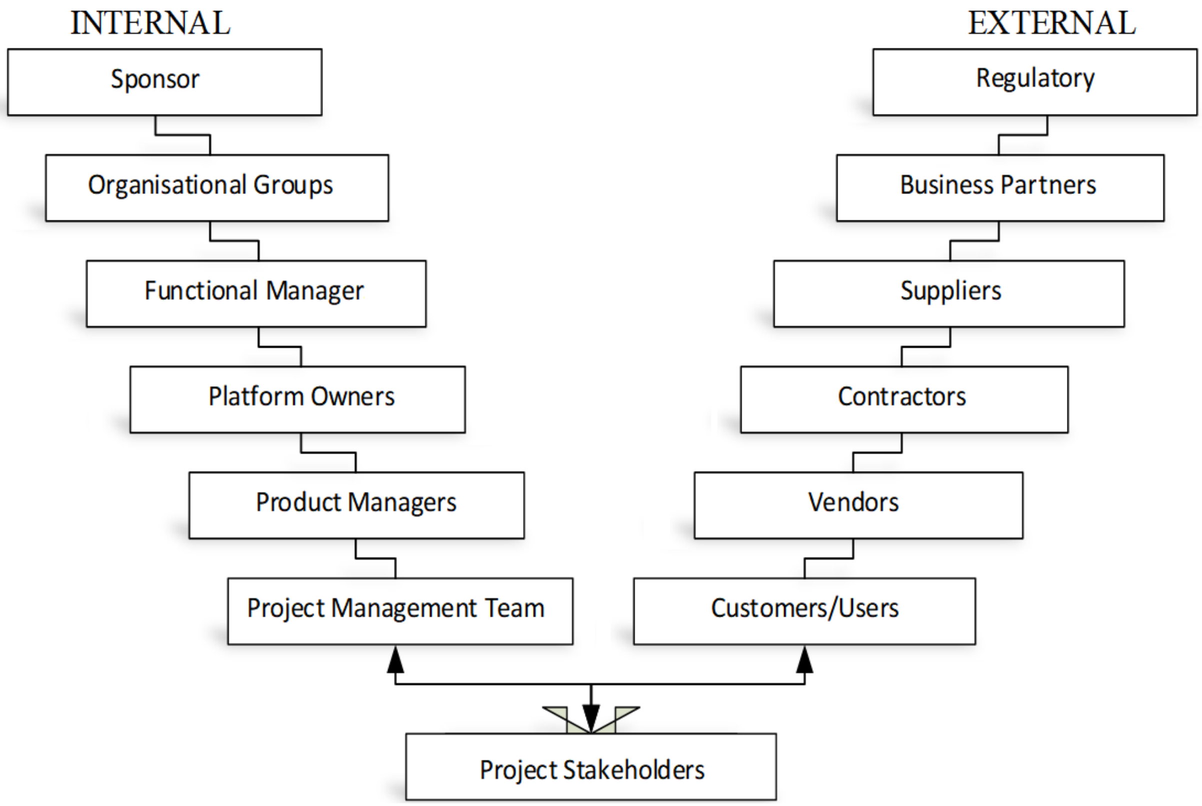


Figure 2.11: Project stakeholders

Source: Adapted from PMBOK® Guide (2013)

Although the above discussion offers a good understanding of how project stakeholders cause overruns, no research has been found that has considered it as a source of value leaks, and that has ascertained its impact on project performance.

There are some identified factors which contribute to cost and time overruns (value leaks) from the project stakeholder's perspective. These value leaks' causal factors in the form of factors, such as overruns and poor quality, that result from the actions of stakeholders include labour absenteeism, inexperience of project team and engineers, incompetence and the non-availability of contractor and subcontractor, and lack of top management support (Bentil *et al.*, 2017; Rauzana, 2016; Al Zadjali *et al.*, 2014; Ade-Ojo & Bablola, 2013; Ahbab, 2012; Ameh *et al.*, 2010).

Currently, no such research exists that has established stakeholder-related factors in projects in the telecommunication industry as value leaks' causal factors, and project stakeholders as a source of origin. The literature review continues with a discussion of the project environment in the telecommunication industry.

2.8.2 Project environment

The project environment encompasses all the internal and external factors that influence the success of projects in the telecommunication industry. These factors can improve or positively or negatively impact the outcome of projects (Ludovico & Petrarca, 2010). Some of the factors in the project environment include:

- Telecommunication industry standards: meeting industry standards to ensure interoperability with the solutions of other mobile network operators and vendors.
- New technologies: evolution of new technologies coupled with third parties, such as vendors and content providers, impacting the development of new services.
- Marketplace conditions: stiff competition within the telecommunication industry ensures that MNOs are constantly revising their business strategies to gain a competitive advantage.

Simushi's (2017) study investigated an integrated management strategy to reduce time and cost overruns on large projects. The study revealed that time and cost overruns originate from the project environment. It can be asserted that value leaks emanate from the project environment, as the overruns are formulated as measures of value leaks. The project environment was viewed from two perspectives: the macro-project environment and micro-project environment. The former considers all the players such as materials' suppliers, labour, professional bodies, unions, pressure groups, governmental bodies, and financial and legal institutions, whose influence has a bearing on the success of the project, whether directly or indirectly. The latter refers to the contracting company or the client agency that owns the project (Simushi, 2017).

In view of this assertion, some factors have been revealed in previous studies to cause value leaks in the form of overruns, and that can be seen as environmentally-related factors. These factors include high labour cost, lack of technical personnel, poor site conditions, fluctuations in the cost of project materials, high inflation and interest rates, arbitration and litigation, as well as government and regulatory policies (Bentil *et al.*, 2017; Akinsiku & Akinsulire, 2012; Ahbab, 2012; Pourrostam & Ismail, 2011; Ameh *et al.*, 2010). Although the above factors provide a fair insight into project overruns, the authors did not attribute these factors to the project environment as the possible source.

Simushi's (2017) study also revealed that factors such as project participants' lack of experience, delays in approving the project, delays in project fund approval, and public pressure that influences the application of project management principles can result in time and cost overruns (value leaks). A project is able to succeed in an organisation that has an environment that is conducive to project activities. A good organisational structure creates an environment that enables the project team to thrive with the minimum of distraction or conflicts (Eskerod & Skriver, 2007; Davidson, 2000).

In view of this, the environmental factors that have the potential to cause value to leak during the project management process include: poor project management, unexpected ground condition, information availability, project team performance, time limit, commercial pressure, procurement route, delays in work approval, waiting for information, material procurement, slow decision-making, shortages of materials, undefined decision-making process, and cumbersome procedures and processes. All of these environmental factors have been found to contribute to the cost and schedule variance of a project (Jackson, 2002; Frimpong, Oluwoye & Crawford, 2003; Veronika *et al.*, 2006).

Furthermore, project management occurs within a project environment, whether it be the physical, external, or general environment (Westland, 2006). There are some organisational factors that influence project management's ability to deliver business value (PMI, 2013). These factors are argued to have come from the project environment, considering the provision presented by the PMI (2013) as illustrated in Figure 2.12. These factors are classified under organisational culture and styles, structure, processes assets, communication and enterprise environmental factors.

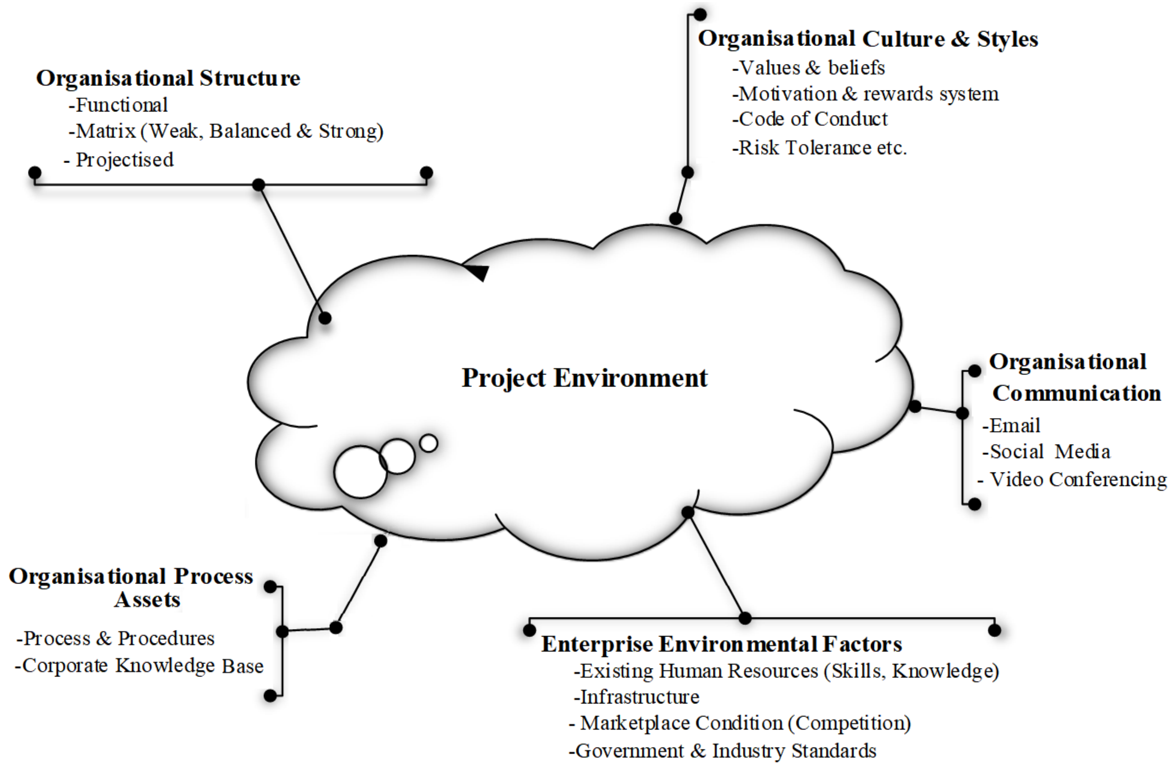


Figure 2.12: Organisational influence on project management

Source: Adapted from PMBOK® Guide (2013)

The above discussion on the project environment provides insight into the occurrence of project overruns, however, the authors did not present the project environment as a possible source of value leaks. There is the need, therefore, to critically analyse the value leaks' causal factors from the project environment, and quantitatively establish its impact on the success of project performance in relation to network expansion projects in the telecommunication industry in Ghana, since little or no such research work has been done in that regard.

The project life cycle is considered to be another source of value leaks' occurrence in project management within the context of this study, as elucidated on below.

2.8.3 Project life cycle

According to Turner (2009), the project life cycle and project management process are intertwined activities geared towards the delivery of a project. The project management process encompasses a set of work activities that are performed at each phase of a project, whereas the project life cycle turns organisational vision into reality.

The project management process is usually divided into stages to offer better management control. These stages are jointly referred to as the project life cycle (PLC)

(PMI, 2017). Turner (2009) describes PLC as the process of turning organisational vision into reality, from ideation to closure. Moreover, PLC represents the series of phases that a project goes through from initiation to closure. Simushi (2017) argued that the occurrence of overruns in the execution phase in the project life cycle results from inaccurate time and cost estimates that were done intentionally to obtain project approval.

Although it is evident that all projects go through various life cycles, research suggests varied composition or constituents in the life cycle of various projects (William *et al.*, 2015; Venter, 2005). However, none of these studies have been able to identify causal factors in the phases of the project life cycle, as this current study aimed to achieve.

Larson and Gray (2011) suggest that there are several types of life cycle models in project management, with many of them being unique to a specific industry or project type. Haverila, Martinsuo and Naumann (2013) and Chou and Zolkiewski (2010) identified three phases that projects go through. They are the planning, execution and delivery phases of a project cycle. In the opinion of the PMI (2017), projects vary in size and complexity; with all of them going through a basic life cycle, irrespective of the industry. The basic life cycle of projects according to the PMI (2017) include: (1) the start of the project, (2) organisation and preparation, (3) execution and (4) project closure, as illustrated in Figure 2.13.

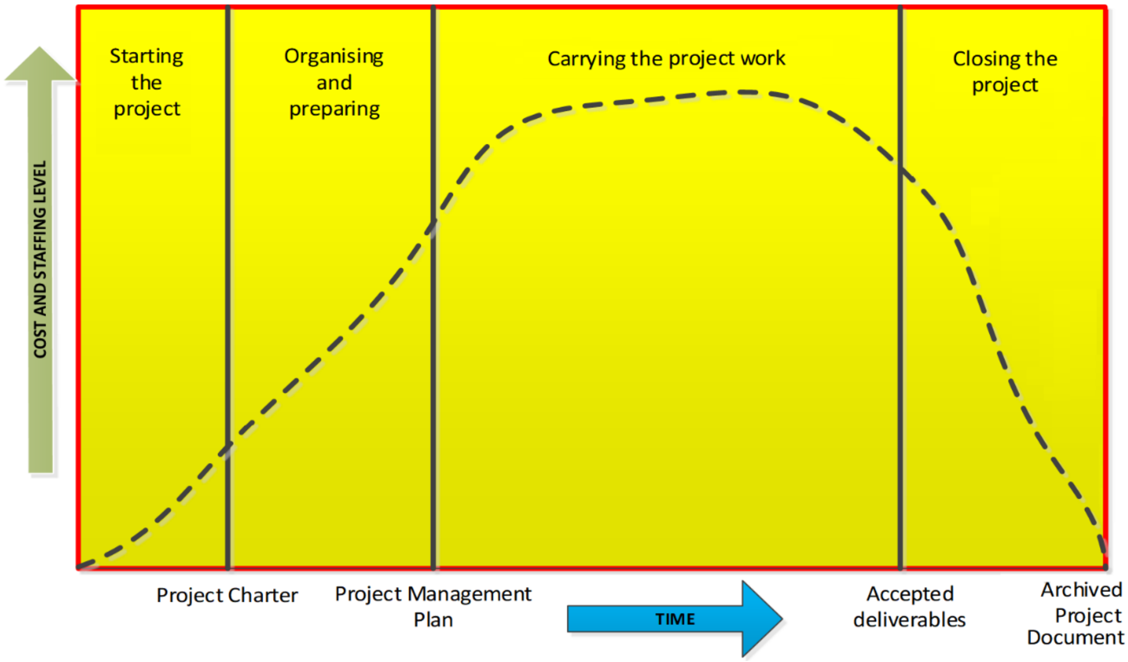


Figure 2.13: Project life cycle

Source: Adapted from PMBOK® Guide (2013)

Similarly, Larson and Gray (2011) identified the fundamentals of a project life cycle as comprising of the definition, planning, execution, and delivery stages, as shown in Figure 2.14. Larson and Gray (2011) further explain that the project effort begins gradually, builds up to a peak, and thereafter drops to the delivery of the project outcome to the customers, as illustrated in the figure.

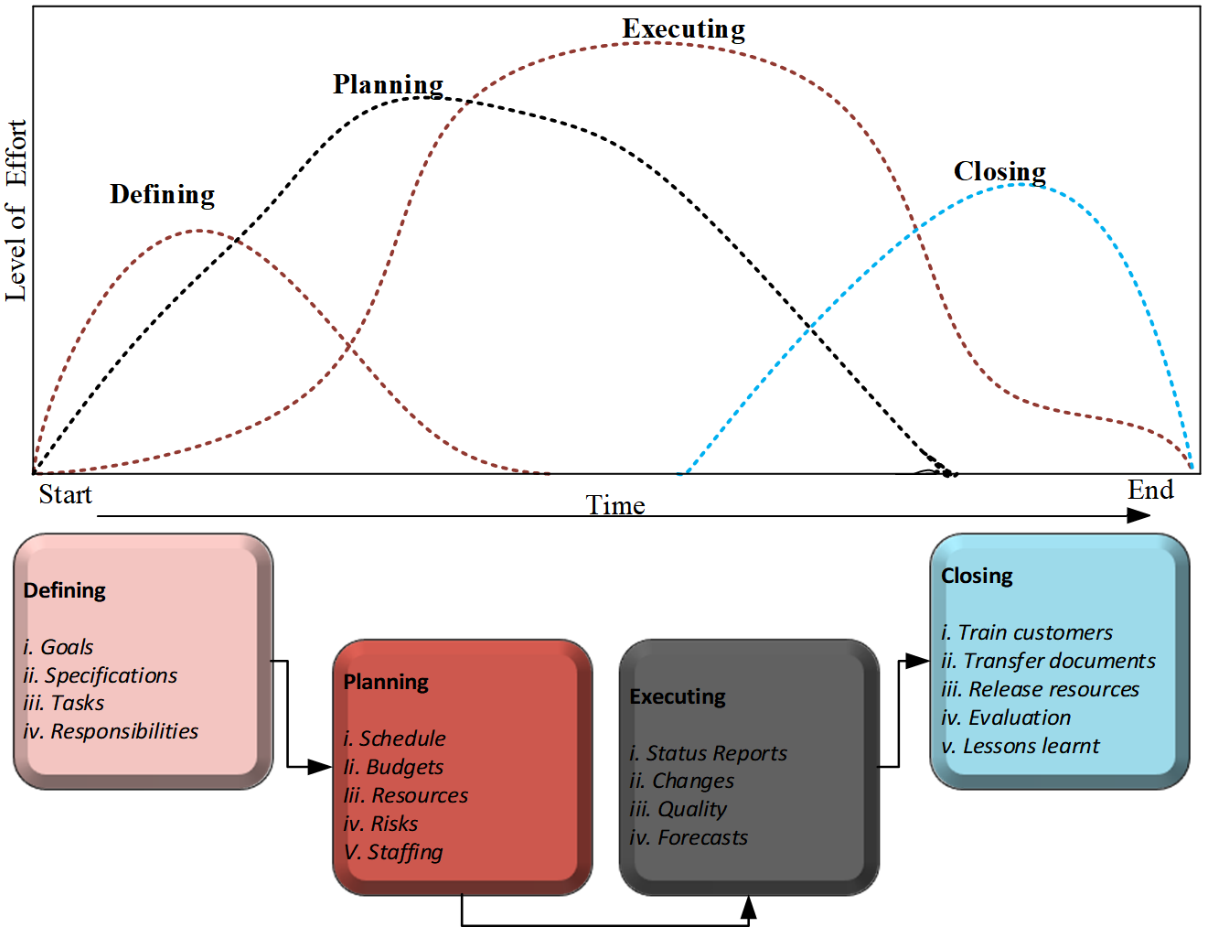


Figure 2.14: Generic project life cycle

Source: Adapted from Larson & Gray (2011)

In the context of the telecommunication industry, Desmond (2004) suggests that a typical project goes through a five-phased life cycle, namely, stakeholder requirements, concept approval, project plan, implementation and handoff. The PMI (2013), and Larson and Gray (2011) explained that at each phase of the life cycle, there are some key activities that have to be performed (as shown in Figures 2.12 and 2.13). The authors explain that most of the issues of cost overruns, time overruns, and scope changes occur during the project execution phase.

Essentially, Ludovico and Petrarca (2010) suggest that the key activities a project manager within the telecommunication industry must focus on should include stakeholder management, time planning and control, cost planning and control, team management, communication management and risk management. Ludovico and Petrarca (2010) added that all these can only be achieved through effective communication with the project teams.

Some common systems or network expansion projects in the telecommunication industry entail some of the following processes: the site survey, order for services (OFS) review, deliverables, project review, coordination, inspection and cutover (GL Communications Inc., 2018).

The discussion that follows expands on the phases and processes of project life cycles in the telecommunication industry, as illustrated in Figure 2.14.

2.8.3.1 Phases and processes of project life cycle

The basis of a project's life cycle is the first stage, which is the initiation or defining stage, as according to Figure 2.14. Project initiation entails having a clear definition of a project's goals, determining project specifications and assembling the team who will work to realise the vision of a project (Larson & Gray, 2011). At the initiation phase, projects are allocated to a project manager who coordinates the development of the project charter during the initiation process. The project charter guides the mapping out of a project prior to its implementation (PMI, 2013; Desmond 2004).

The second phase of the project life cycle is the planning. It includes the drafting of the project management plan, and factors in activities such as defining the project scope, cost estimation and budgeting, preparation of project activities, and timelines, as well as clearly defining the project's quality requirements (PMI, 2008). As the project progresses, the dynamics may change. Therefore, it is imperative that contingencies are factored in during the planning process (Larson & Gray, 2011). According to Desmond (2004), the planning phase of telecommunication projects entails activities such as completing the scope definition, detailing project budget, and defining resources, and so forth.

Project execution constitutes the third phase of the project cycle. It is at this stage that the actual work is implemented to deliver the physical product (Larson & Gray, 2011). The execution phase is characterised by activities that are involved with the development and management of project teams, management of team performance, quality checks, and ensuring general oversight of the progress of the project (PMI, 2013). As seen in Figure 2.14, schedule, cost and budget specifications are used to control project performance. These measures essentially dovetail into the project's ability to stay on schedule, on budget, and according to the required specifications (Larson & Gray, 2011).

The last phase is project closure which entails the following three main activities: delivering the project outcome, whether it is product or services to the customer, redistributing the project resources, and the post-project review (Larson & Gray, 2011). The PMI (2013) indicated that this is where project deliverables are accepted by the sponsor or customer, and where they conduct the post-project review, during which they document the lessons learnt, and dissolve the project team. As shown in Figure 2.14, Larson and Gray (2011) explained that providing the project outcome to the customer often includes on-usage training to the customers and the transfer of documents. Redistribution can also entail releasing project equipment/materials to other projects and assigning team members to other projects.

2.8.4 Classification of value leaks' causal factors under their origin

The literature review has allowed this study to identify several predominant causal factors of value leaks that were discovered by a range of researchers in various different countries. Some of these factors have been classified under their potential sources of occurrence during the management of a project.

Table 2.5 (on the next page) lists the factors that originate from the project life cycle, the project stakeholders and the project environment. Nevertheless, no previous research work has investigated these three sources of value leaks' causal factors, and examined which of these sources produces the most impactful factors on project performance. Therefore, there is the need to consider the factors that emanate from all these main sources within the context of the telecommunication industry in Ghana. Also, to establish their impact on project performance and to develop a diagnostic tool to minimise the impact of these occurrences. Subsequently, a discussion on the proposed value leaks diagnostic model is presented, which resulted from a review of value leaks, EVA technique, measures of value leaks, causal factors and their sources of origin.

Table 2.5: Classification of value leaks' causal factors under their sources

SOURCES OF VALUE LEAKS CAUSAL FACTORS	VALUE LEAKS CAUSAL FACTORS	Authors, the industry and their Country for the Study																				
		Bentil et al.,(2017)-Const. (Ghana)	Rauzana (2016)-Const. (Indonesia)	Vaardini et al. (2016)-Const. (India)	Al Zadjali et al., (2014)-Telecom (Oman)	Hasan et al. (2014)-Const. (Bahrain)	Ade-Ojo & Babalola (2013)-Const.(Nigeria)	Alinaitwe et al. (2013) -Const. (Uganda)	Murray & Seif (2013)-Const. (Nigeria)	Sweis (2013)-Const. (Jordan)	Rahman et al. (2013)-Const. (Malaysia)	Marzouk &El-Rasas (2013)-Const. (Egypt)	Danso & Antwi (2012)-Telecom (Ghana)	Ali et al.,(2012)-Const. (Malaysia)	Akinsiku & Akinsulire (2012)-Const. (Nigeria)	Ahbab (2012)-Const. (Cyprus)	Pourrostam & Ismail (2011)-Const.(Iran)	Ameh et al. (2010)-Telecom (Nigeria)	Kaliba et al. (2009)-Const. (Zambia)	Ting & Wong (2009)-Const.(Malaysia)	Department Of Enerby (2008)-USA	Veronika et al. (2006)- Const. (Thailand)
PROJECT LIFECYCLE FACTORS	Inaccurate Time and Cost estimates	√	√		√		√		√		√		√		√		√	√	√	√	√	
	Incomplete & error in Project Requirement/Specification	√	√				√		√		√		√				√	√			√	√
	Improper Planning & Schedulling	√	√	√			√		√		√		√		√		√	√	√			
	Poor scoping	√						√		√	√	√	√		√		√	√				√
	Poor decision making process				√								√	√							√	√
	Delay in Payment to Vendors/Supplier/Subcontractor		√					√	√				√			√	√	√	√			
	Frequent Design Changes	√			√		√		√	√	√		√			√						
	Poor Stakeholder Coordination & Communication						√						√	√		√		√	√	√	√	
	Poor Monitoring & Control	√		√			√		√	√	√		√			√		√				
	Changes in Project Scope	√	√	√	√	√	√	√	√		√		√	√	√	√	√	√	√		√	
	Poor Project Management						√				√		√			√		√				√
	Late delivery of Materials & Equipment						√				√		√				√	√		√		
	Poor Supervision and Site Management			√			√				√		√	√	√			√				
	Too many reworks due to Poor Quality		√					√	√				√			√	√	√			√	
	Poor Contract Management	√				√							√				√	√				
	Mistakes and defective works		√		√					√			√	√					√	√		√
	Lack of Quality Assurance and Control	√						√					√			√						√
PROJECT STAKEHOLDERS FACTORS	Labour Absenteeism								√			√			√					√		
	Inexperience Project Team/Engineers		√			√					√		√	√	√	√	√	√	√			
	Incompetent Contractor & subcontractor										√					√		√			√	
	Non-availability of Contractors and Subcontractor	√		√			√						√	√		√		√	√		√	
	Lack of Top Management Support				√																	√
PROJECT ENVIRONMENTAL FACTORS	High Cost of Labour		√			√				√								√				
	Shortage of Technical Personnel							√				√				√		√			√	
	Fluctuation of Prices of Materials	√		√					√						√	√		√			√	
	High Inflation & Interest Rates	√						√		√		√			√	√	√	√	√		√	
	Major dispute/ negotiation at site					√							√			√	√	√			√	√
	Arbitration and Litigation												√				√	√				
	Government Policies (laws and regulations)		√			√				√			√	√	√	√	√	√	√			√
	Bad Weather/ Poor Site Conditions							√	√		√			√	√	√	√	√	√			√

Source: Researcher's own compilation (2019)

2.9 CONCEPTUAL FRAMEWORK

Figure 2.15 was developed to illustrate a proposed diagnostic model from the literature review to explain the concept of value leaks in telecommunication projects which would statistically be tested through case and survey studies. This proposed diagnostic model strongly emerged from the formulation of value leaks measures (Figure 1.1), EVA indication of value leaks occurrence in a project (Figure 2.10), project stakeholders (Figure 2.11), organizational influence on project management (Figure 2.12), and project life cycle (2.13).

The proposed value leaks model can help in identifying, controlling, and remedying its occurrence in network expansion projects within the telecommunication industry. The Model postulates that value leaks emanate from the occurrence of five key measures, namely, cost overrun (CO), time overrun (TO), out of scope (UP), poor quality (PQ) and project team dissatisfaction (TD) during project implementation.

The Model further posits that the EVA technique is used to measure project performance. Although, through EVA application, out of scope, time and cost overruns may be ascertained, but it does not involve quality and team dissatisfaction in its application. Similarly, the EVA does not recognise value leaks in its calculation and provides no reasons for the variance occurrence in project management. However, the model postulates that it is imperative to include value leaks, as it gives information on the project value that has gone unrealised, and because EVA is the common technique used in assessing project performance. The factors that cause value leaks with respect to its measures, are seen to originate from the following three sources:

Firstly, the Model indicates that a project goes through a systematic process known as the project life cycle, which turns the project inputs into business value. At each stage of the project life cycle, there are some activities that have the potential to result in value leaks if not effectively performed. Among such factors are inaccurate time and cost estimates, improper planning and scheduling, changes in project scope, and the late delivery of materials.

Secondly, the project stakeholders are impacted by the outcome of a project. The activities of project stakeholders also have the potential to cause value leaks that may undermine the ability to realise the full value of the project. The factors classified under the stakeholders involve poor stakeholder coordination, lack of communication skills, inexperienced contractors, lack of project team experience, and lack of top management support.

Thirdly, the project environment where the project is being carried out. The factors that cause value leaks from the project environment, and which avert the full realisation of the earned value include changes in organisation management and leadership, market conditions, and an unsupportive organisational culture.

Finally, the Model concludes that in an attempt to deliver overall business value, the identified factors and their sources should be monitored and keenly controlled to minimise value leaks during project implementation.

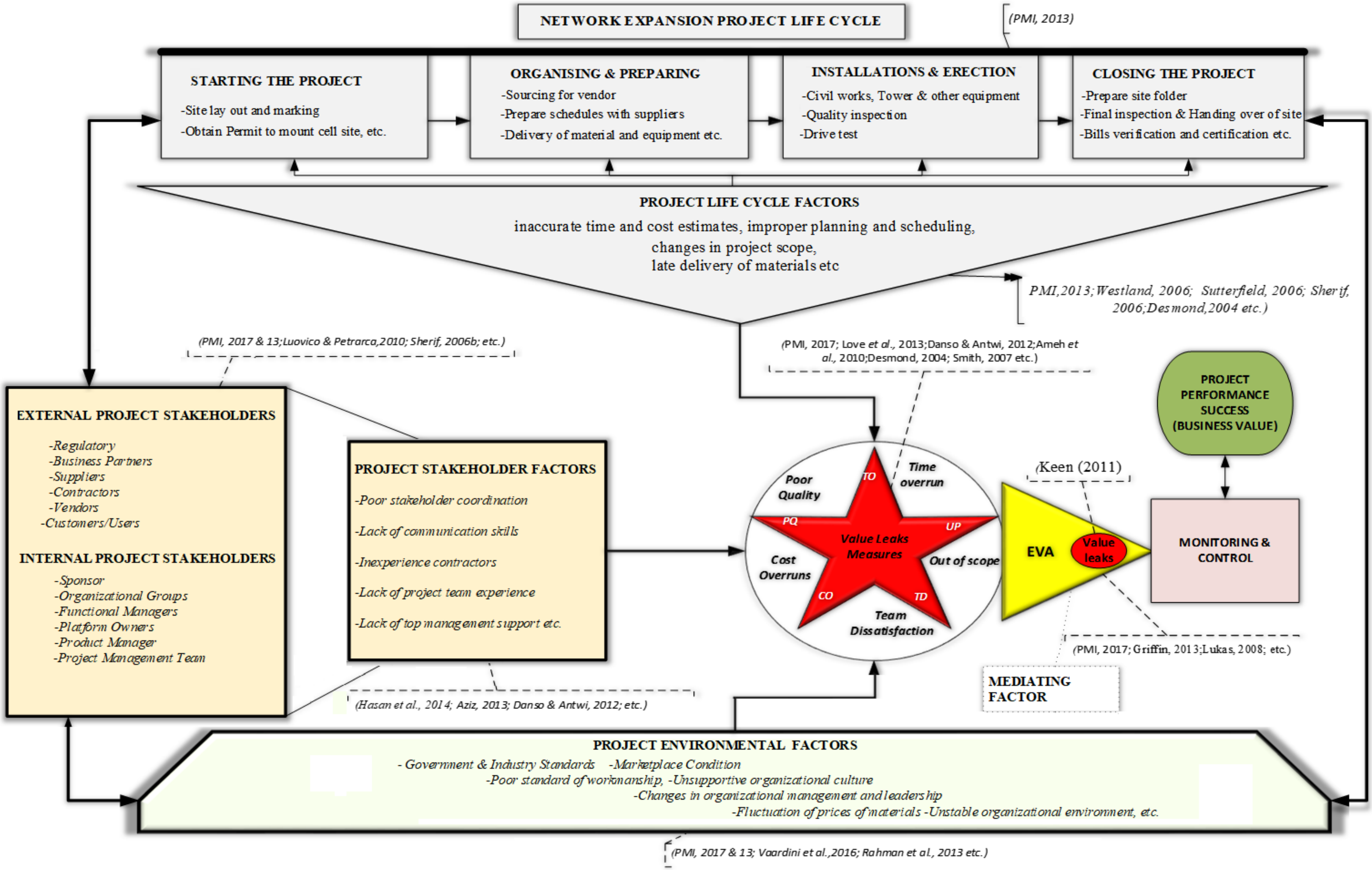


Figure 2.15: Proposed Value Leaks Diagnostic Model

Source: Researcher's own construct (2019)

2.10 CHAPTER SUMMARY

This chapter presented the literature review highlighting network expansion projects in the Telecommunication sector, with a special focus on Ghana, and the concept of creating value through projects. The triple constraint theory, namely, cost, time, and scope was presented as the theoretical approach employed in this study. Among the techniques to control and manage the triple constraints in order to achieve project success is EVA, which is considered as the most powerful tool and standard measure of project performance that has been adopted by many organisations.

In spite of the benefits of EVA in measuring project performance, its key limitation is the fact that it does not factor in the computation of value leaks in its measurement variables. Moreover, EVA does not provide reasons for the variance occurrence in projects and how to mitigate them. Hence, the proposal of value leaks as an extension to EVA.

A conceptual framework for project value leak was proposed, as the concept of value leaks is still a novel concept in the field of project management and little is known about it. Although some researchers have attempted to provide insight into possible factors that may result in value leaks in terms of specific value leak measures, many of these research works are outdated, and no single study has integrated all five factors to assess value leaks. This apparent gap in the current knowledge on the concept of value leaks has therefore prompted the need for this study.

The next chapter presents the research methodology that was employed in the study, namely, how the case and the survey studies were carried out.

CHAPTER 3:
RESEARCH DESIGN AND METHODOLOGY

3.1 INTRODUCTION

This chapter presents the research design and methodology for the empirical research conducted in this research study. This discussion provides detailed information about the research methodology that was briefly introduced in Chapter 1.

In view of this, the Research Framework, as shown in Figure 3.1 on the next page, is the research layout developed to highlight the systematic processes of the study. The research design stage provides the research's philosophical worldview which underpins the study, the research approaches, and their corresponding strategies. Also, the research method details the processes through which both the qualitative and quantitative studies were carried out, as elaborated on in the subsequent sections.

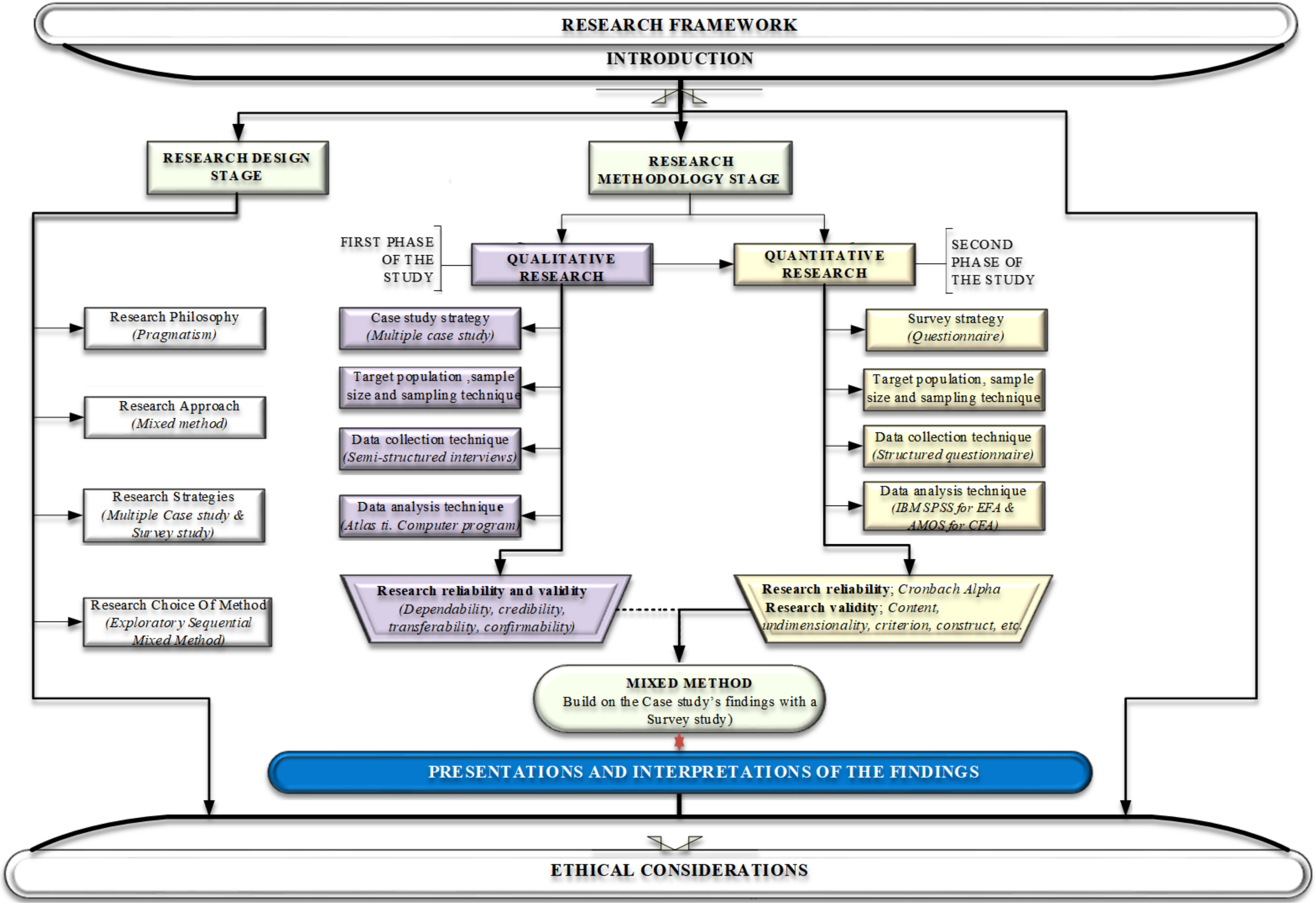


Figure 3.1: Research framework

Source: Researcher's own construct (2019)

3.2 RESEARCH DESIGN STAGE

Burns and Grove (2003) describe research design as a plan that guides the researcher to achieve the expected results of a study. According to Creswell (2014), it is a plan which guides the implementation of the research. As shown in Figure 3.2, the research design is the intersection of:

- A research philosophy which underpins the study;
- The research strategy or approach, also referred to as the Procedure of Inquiry; and
- Specific methods of data collection, as well as its analysis and interpretation.

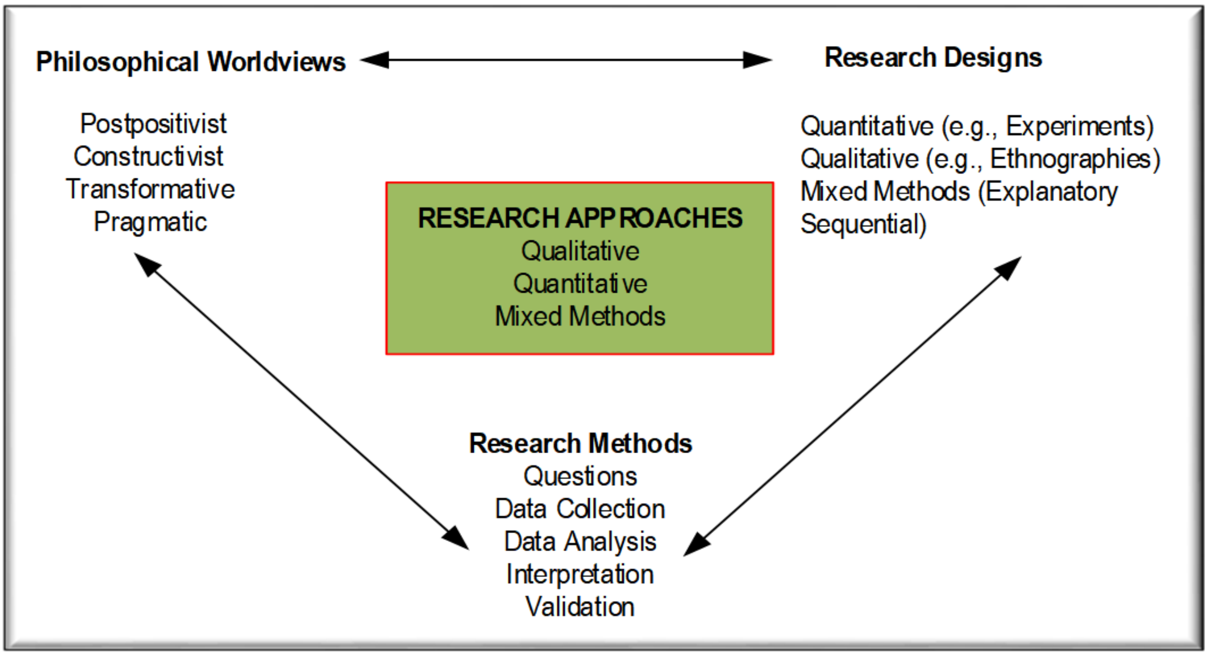


Figure 3.2: Intersection of research philosophy, designs, and specific methods

Source: Creswell (2014)

3.2.1 Research philosophical worldviews

According to Lincoln and Guba (1985), research is grounded on varied perceptions, beliefs and assumptions, which influence the nature in which it is conducted from design to conclusion. Thus, it is imperative that different paradigms are considered in viewing the science of research; that is determining what the underlying philosophy and assumptions about a phenomenon, or an event are (Haase & Myles, 1988; Munhall, 1982; Kuhn, 1970). Creswell (2014) terms these philosophical ideas as 'worldviews'. According to the Guba (1990, p.17), a worldview constitutes "a basic set of beliefs that guide an action". Other terminologies that have been used to describe research include epistemology and ontology (Crotty, 1998; Eisner, 1992), doxology (Fuchs, 2005; Jensen, 2000), and conceived methodology (Neuman & Strack, 2009). Epistemology is described as an idea or knowledge that is known to be true. Doxology is merely a belief in an idea (Fuchs, 2005). Eisner (1992) describes ontology as something that is in existence.

Creswell (2014) argues that the individual beliefs assumed by researchers influence the methodological approach they take in their research, whether qualitative, quantitative, or mixed methods. Albeit, there is still an ongoing debate about what worldviews or beliefs individual researchers should bring to inquiry (Creswell, 2009). Nevertheless, Humphreys and Watson (2009) and Bryman (1984) assert that one belief may be more appropriate than another in terms of a specific study, although none is necessarily more superior. That notwithstanding, Creswell (2014) presents the most widely applied research philosophies as:

- The **post-positivist** philosophy epitomises the traditional forms of research. It is perceived to assume a quantitative research approach rather than a qualitative approach.
- The **constructivist** philosophy assumes that persons seek understanding of the world in which they live and work, and seek to obtain a complexity of views rather than narrowing meanings into few ideas. It is centred on qualitative research rather than quantitative research.
- The **transformative** philosophy focuses on the relevance of studying the lives and experiences of diverse groups, and persons like homosexuals and transsexuals who have conventionally been alienated.
- **Pragmatism** is a philosophy that assumes the mixed-methods approach to gain knowledge about a problem

3.2.1.1 Choice and justification of the study's philosophical assumption

The researcher assumes a pragmatism worldview to the study. This worldview gives freedom as to the choice of methods, techniques, and procedures that best meet the study's need (Creswell, 2014). As argued, pragmatism applies both quantitative and qualitative methods, and is an approach that has been used by researchers to collect and analyse data over the years (Morgan, 2007; Creswell, 2014). Moreover, the World is not an absolute unit that necessitate a single system of philosophy and reality (Cherryholmes, 1992; Morgan, 2007; Creswell, 2014).

The study, therefore, combines both positivism and interpretivism philosophies, firstly to explore the concept of value leaks from a qualitative perspective, and secondly, to determine quantitatively the impact of value leaks on the performance of project management.

3.2.2 Research approaches and strategies

Creswell (2014) has identified three ways to approach research. They are quantitative, qualitative, and mixed methods. These methods have respective strategies that accompany their selection, as shown in Table 3.1, and the details are expounded thereafter.

Table 3.1: Synopsis of research approaches and their respective strategies

Research approach	Quantitative	Qualitative	Purpose
Research strategies	Experimental design Survey (Non-experimental design)	Narrative Phenomenology Grounded theory Ethnographies Case study	Convergent Explanatory sequential Exploratory sequential

Source: Adapted from Creswell (2014)

3.2.2.1 Qualitative research approach and strategies

Qualitative research assumes an interpretive social sciences philosophy where investigations are built on the relevance of subjectivity (Babbie & Mouton, 2007). Therefore, qualitative research is explained as the act of analysing subjective meanings, concepts, definitions, symbols, and descriptions of social events, issues, or norms through the collection of non-standardised data (Flick, 2014; Berg & Howard, 2012).

In view of this, Bryman and Bell (2007) asserted that qualitative research offers the opportunity to gain an in-depth understanding about the views and experiences of people. Essentially, researchers are able to understand respondents better through their expressions and experiences, particularly when there is no available information on the specific subject matter (Leedy & Ormrod, 2014). Qualitative data uses the following research instruments to elicit data from research participants in their natural setting: observation, open-ended questions, in-depth audio or video interviews and field notes. The process offers detailed information about people in a real-life context (Leedy & Ormrod, 2014; De Vaus, 2014; Babbie & Mouton, 2007). With the in-depth solicitation of the required information, qualitative research typically entails a small number of participants during the research process (Hofstee, 2006). Thus, qualitative research generally does not cover a wide population during the research process (Saunders *et al.*, 2009; Babbie & Mouton, 2007; Hofstee, 2006).

According to Flick (2014), analysing qualitative data employs the predominant use of texts and images, as opposed to the use of figures and statistics. Rahman (2017) argues that qualitative research has its pros and cons. For example, qualitative studies give researchers the advantage to obtain in-depth insight into the feelings, experiences, and opinions of target subjects (Rahman, 2017). Researchers are also able to deduce intangible elements through the voices and demeanour of subjects. Furthermore, qualitative research gives more accurate and vivid evidence of data, given the technique's use of words and pictures as data collection instruments (Johnson and Christensen, 2012).

Conversely, qualitative research tends to ignore contextual sensitivities due to the emphasis it places on meanings and experiences (Rahman, 2017; in quoting Silverman, 2010). This puts the validity of qualitative data into question, thus influencing the choice for quantitative data in decision-making (Sallee & Flood, 2012). Moreover, the applicability of qualitative data is limited by the choice of a small sample size, as the data cannot be generalised to a sample population. Besides, the case by case analysis of qualitative data can be cumbersome (Harry & Lipsky, 2014; Flick, 2011).

Research strategies employed by qualitative research include narrative, phenomenology, grounded theory, ethnographies, and case study (Creswell, 2014). These strategies are briefly explained below.

- **Narrative research:** this comprises the combination of opinions from the life of the participants and that of the researcher in the form of a collaborative narrative (Creswell, 2014; Clandinin & Connelly, 2000).

- **Phenomenology research:** the researcher describes people's lived experiences about a phenomenon, as explained by the participants (Creswell, 2014).
- **Grounded theory:** assists in the building and development of theories (Goulding, 2002). Creswell (2014) in quoting Charmaz (2006) and Corbin and Strauss (2007), affirmed that grounded theory is where the study seeks to derive an abstract theory of a process rooted in the viewpoints of a study's participants.
- **Ethnographies:** this is most preferred when seeking a better understanding of subjects in their natural habitats or through the lens of their 'social world' (Saunders *et al.*, 2009):
- **Case study:** refers to the empirical investigation of specific event in its real-life context, aided by multiple sources of evidence (Robson, 2002). Saunders *et al.* (2009) argue that a well-structured case study strategy grants the ability to challenge an existing theory and to produce a source of a new set of research questions.

3.2.2.2 Quantitative research approach and strategies

Babbie and Mouton (2007) assert that the main objective of quantitative research is to test and confirm a theory, rather than to propound a new theory. Essentially, quantitative research is opposite to qualitative studies, in that the former works with numerical-based/standardised data, while the latter is predominantly word-based (Saunders *et al.*, 2009).

Quantitative research provides answers to questions like 'how many?', 'how much?', 'to what extent?' (Rasinger, 2013). It employs the use of graphs, charts and tables in displaying research data (Saunders *et al.*, 2009). Rahman (2017, in citing Carr, 1994) identifies some merits of quantitative research. This includes the use of a wider population in data collection. Thus, the interpretation of quantitative data can be generalised to whole populations, as it confers some amount of confidence and validity (Hofstee, 2006).

Criticism of quantitative research is that it is observed to ignore the fundamental meanings of social phenomena without identifying the basic meanings and explanations (Rahman, 2017). Ary, Jacobs, Sorensen and Walker (2013) argue that quantitative research does not account for intangible experiences within test environments because there is no direct interaction between researchers and subjects. Essentially, quantitative research is not able to deduce human interaction within and between subjects (Blaikie, 2007).

The underlying techniques for quantitative research are summarised below:

- **Survey research:** offers quantitative or figure description of perceptions, trends and opinions of a population. It investigates population samples by applying questionnaires or structured interviews to collect data. The data is then generalised from the sample to the population of the study (Creswell, 2014; Fowler, 2008).
- **Experimental research:** ascertains the influence of a particular treatment on an outcome. Thus, experimental studies enable researchers to apply treatments administered to groups, and then measure the performance of the groups based on an expected outcome (Creswell, 2014).

3.2.2.3 Mixed-methods research approach and strategies

According to Hoover and Krishnamurti (2010), mixed methods provide a detailed understanding of topics because they make use of a combination of qualitative and quantitative research techniques (Creswell, 2014). Bargman (2008) argues that using mixed methods provides greater validity because the integration of qualitative and quantitative data ensures the corroboration of facts.

Mixed methods entail the collection, analysis, and combination of data either in a single or multiphase study, and it is typically rooted in the pragmatic epistemology (Guba & Lincoln, 1994). Moreover, Bargman (2008) adds that mixed-methods research boosts the credibility of data and improves the integrity thereof. Johnson and Onwuegbuzie (2004) outline some of the strengths of mixed-methods design to include:

- Use of words, images, and narratives from qualitative research to enhance the interpretation of numerical values;
- Use of numerical values to augment the precision of words, images, and narrative;
- Encompasses the strengths of both qualitative and quantitative researches;
- Ability to efficiently deduce research questions because of the multiple approaches to the study;
- Ease of generalising research findings to the whole population; and

- Providing more insight and understanding to research findings, which otherwise would have been omitted in the application of a single method.

However, Johnson and Onwuegbuzie (2004) identified some weaknesses of mixed methods, including the fact that it tends to be cumbersome. The demanding nature of qualitative data collection, coupled with the difficulties associated with obtaining some types of quantitative data, makes the mixed-method approach time-consuming and expensive (Creswell & Plano Clark, 2011). Essentially, the approach requires the need for a skilled researcher who is able to efficiently apply the mix of quantitative and qualitative information-sourcing techniques (Johnson & Onwuegbuzie, 2004).

This notwithstanding, O'Cathian, Murphy and Nicholl (2007) perceive mixed research as the most preferred approach because it accounts for the individual limitations of qualitative and quantitative research. Creswell (2014) identifies and explains three basic mixed-methods designs, as discussed below.

- **Convergent parallel mixed methods:** this design comprises the collection, analysis and interpretation of both quantitative and qualitative data. Inconsistencies in research findings are clarified or further investigated using this mixed research method.
- **Explanatory sequential mixed methods:** this starts with quantitative research. Data from quantitative research is analysed, and serves as the foundation on which to conduct a qualitative study to further elaborate on the research results. The sequential mixed method is labelled 'explanatory' because qualitative research is used to explain the values obtained from the quantitative data.
- **Exploratory sequential mixed methods:** in this design, a qualitative study is first conducted to explore the views and opinions of the research subjects. The resulting data is analysed and serves as the foundation on which a quantitative research is conducted.

3.2.2.4 Rationale and justification for the choice of research approach and strategy

The current section discusses the choice of research approaches and their respective strategies employed for the study.

Mixed-methods approach

The selection of a philosophical worldview informs the choice of inquiry into the study (Creswell, 2014). Thus, the study adopted a mixed-methods approach as it lays grounds for the pragmatic philosophical worldview to make inquiry into the research problem (Creswell, 2014). Mixed methods inspire confidence in the research findings as sufficient evidence is provided to mitigate the weaknesses associated with a single method approach (Caruth, 2013; Creswell & Plano Clark, 2011; Bryman, 2004).

Seen in this light, the rationale behind this choice lies in the fact that there are no empirical studies that have situated the occurrence of value leaks in project management performance. There is, therefore, the need to explore and gain insight into the causal factors of value leaks, as well as their impact on project performance using a mixed-methods design (Coyle & Williams, 2000; Tashakkori & Teddlie, 2003b).

In addition to the above-mentioned, the aim of employing mixed-methods research is to capitalise on the strengths of both the qualitative and quantitative approaches. This will ensure that potential weaknesses arising from the individual techniques are curtailed, thereby enhancing the quality of the data collected (Saunders *et al.*, 2009; Scott & Morrison, 2007; Johnson & Onwuegbuzie, 2004; Guba & Lincoln, 1994). Aside from obtaining detailed information, the mixed-method approach would guide the in-depth investigation into the value leaks concept in project management performance, and it would create a wider perspective of the research problem, enhancing the rich interpretation of the results, and ensuring a better understanding of the factors that cause value leaks.

Furthermore, the study used the exploratory sequential mixed method, and the intent behind it was that the study sought to do a qualitative investigation with a small sample size, and then to ascertain the findings quantitatively using a large sample size (Creswell & Plano, 2011). According to Creswell and Plano (2011), the outcome of the qualitative study influences the research instrument to be used in the quantitative phase. Thus, making the choice of the exploratory sequential mixed method the best approaches.

Furthermore, Saunders, Lewis and Thornhill (2009) acknowledge the importance of certain elements in ensuring the successful implementation of a research. These include the research questions and objectives, the level of knowledge regarding the subject matter, time, and resources constraints, as well as the philosophical worldview of the researcher. These elements have been taken into consideration for the purpose of this study, and in turn have influenced the choice of strategy, including the case study approach which is discussed next.

Case study strategy

The study adopted a multiple-case study strategy for the qualitative research involving project management practitioners (project directors, project managers, head of departments, rollout managers) as the unit of analysis. A unit of analysis entails the element being studied and analysed in scientific research (Dolma, 2010). In the context of the telecommunication industry, the multiple-case study approach gives the researcher the chance to determine whether there are overlaps or trends between cases, and as a result, inform the generalisation of data from case findings (Creswell, 2014; Saunders *et al.*, 2012; Yin, 2003; Robson, 2002).

Survey method strategy

The survey method was used to establish the concept of value leaks. Essentially, the study elucidated information on the occurrence of value leaks, and the extent to which they impact project performance in network expansion project deployment. The study sought to mitigate the weaknesses associated with the survey method through the elimination of bias-inclined content. For example, by taking care during the dissemination and management of questionnaires, and employing efficient methods to elicit responses from surveys (Rubin & Babbie, 201; Fink, 2009; Fowler, 2009).

3.3 RESEARCH METHODOLOGY STAGE

The research methodology is defined as the overall approach that provides the processes of undertaking the research (Saunders *et al.*, 2012; Collis & Hussey, 2009). As a mixed research method, this research was categorised into the Qualitative research in Phase I and the Quantitative research in Phase II, as discussed in the next sections.

3.3.1 Qualitative research: Phase 1

The qualitative research was done in the first phase of the study. Qualitative techniques use text and imagery data, while drawing on diverse designs to analyse data (Creswell, 2014). It works with non-numerical values and is conducted using a small sample size, usually through purposive sampling (Delport & De Vos, 2011). Based on this, the study used a small sample size as justified in Section 3.3.1.2 in formulating the value leaks concept.

In this qualitative research phase, the researcher is the main data-collection instrument through the interviews with the participants (Lincoln & Guba, 1985), with the data collected being descriptive in nature (Fraenkel & Wallen, 1990; Marshall & Rossman, 1989).

Qualitative studies are founded on the perceptions, views, experiences, and thoughts of people (Locke *et al.*, 1987). Therefore, data from qualitative research tend to be in-depth and exhaustive. Essentially, this informed the reasoning behind the study's investigation into the occurrence of value leaks, their causal factors and where they emanate from in the project management process (Fraenkel & Wallen, 1990).

3.3.1.1 Case study strategy

The study adopted a multiple-case study strategy to study four (4) different companies to gain insight into the concept of value leaks during project deployment within the context of telecommunication network expansion projects in Ghana. A multiple-case study approach offers great understanding of the differences and similarities between the cases, and their findings are considered strong and reliable (Baxter & Jack, 2008). Moreover, the multiple-case study method provides the researcher with the chance to determine whether there are overlaps or trends between cases, which as a result, inform the credibility of the data from the case findings (Creswell, 2014; Saunders *et al.*, 2012; Yin, 2003; Robson, 2002).

Given the limited amount of research on value leaks in telecommunication project management, the multiple-case study is found appropriate to explore the concept within each case and across cases. Therefore, the researcher would gain rich insight into and a better understanding of the phenomenon, namely, value leaks during network expansion projects (Yin, 2015; Dyer *et al.*, 1991).

3.3.1.2 Target population, sample size and sampling technique

Creswell (2014) argued that qualitative data is usually smaller than quantitative because it is situated in a small sample. Scott and Morrison (2007) describe sampling as a process of selecting a group from a wider population, such that the selected group is representative of the entire population.

For this case study, the researcher received permission and access to four (4) cases out of a possible nine (9), which work on network expansion projects, either as the project owners (mobile network operators) or the contracting vendors (tower companies and managed-service vendors) (National Communication Authority in Ghana, 2018; Osei-Owusu & Henten, 2017). The reasons received for their non-participation from the remaining five cases are that their resources are unable to avail themselves for the interview process as they spend most of their time on site.

The four (4) participating cases include: two (2) of the four (4) mobile network operators (Vodafone Ghana limited & AirtelTigo Ghana limited) and five (5) contracting vendors (Ericsson & Huawei Technologies Limited) in the telecommunication industry in Ghana. This number of cases is in accordance with Eisenhardt's (1989) recommendation of four to ten cases in the sample.

In the same vein, the minimum sample size for a case study recommended by Creswell (2002) is three to five cases. As the company size of mobile network operators (MNOs) is observably larger than that of the contracting vendors, the study selected two (2) senior project management practitioners from each network operator and one (1) from each contracting vendor. Nevertheless, the study used pseudonyms to represent the names of these companies and their staff during the report on their specific practices and experiences (see Table 3.1 for summaries).

In line with this, the study recruited six (6) senior project management practitioners through the use of purposive sampling for the interviews. The functional roles of the participants range from project/rollout manager to programme director, and all of them are highly recommended based on their in-depth understanding, knowledge and level of experience on network expansion projects in their respective companies.

The study used purposive sampling because it is considered to be the most suitable method, as it offers flexibility on the selection of the research subjects, and also in terms of the sample size (Saunders *et al.*, 2012).

3.3.1.3 Qualitative data-collection technique

In soliciting qualitative data for a study, Creswell (2013; 2014), and Marshall and Rossman (2011) outline four basic types of data-collection methods, namely, observation, interviews, review of documents, audio and visual materials. Yin (2018) argued that the sources of data for case study may include one or more of the following: (a) documentation, (b) archival records, (c) interviews, (d) direct observation, (e) participant observation, and (f) physical artifacts.

However, the current study used interviews and review of physical artifacts (project plans) to collect data from these selected senior project management practitioners. Due to proprietary and confidential policies regulating information dissemination within the telecommunication industry in Ghana, the study obtained access to the project plans. The rationale behind the selection of the interview technique is to allow the researcher to delve into the subject matter and probe it to greater depth.

- **Qualitative interviews**

  According to Creswell (2014), interviews are used to solicit the views and opinions of people. They may take the form of face-to-face interviews, telephone or focus group discussions. Yin (2003) describes qualitative interviews as a technique which allows the elicitation of information through guided conversations. Moreover, qualitative interviews provide rich and in-depth information from the standpoint of research subjects and thus, obtaining direct access to their personal experiences (Turner, 2010; Wilkinson & Birmingham, 2003).

  Researchers can also uncover historical information using qualitative techniques. Qualitative interviewing techniques are relevant when the observation method cannot be employed. This gives the researcher control over the line of questions to ask. However, the presence of researchers during the data-collection process may influence responses, and generate bias in the data collected (Creswell, 2014).

  The three kinds of qualitative interviews are open-ended, also known as unstructured questions interview, semi-structured questions interview, and structured questions interview (Yin, 2003; Sekaran, 2003; Robson, 2002): (1) Open-ended or unstructured interviews elicit perceptions, opinions, and facts from subjects without any specific plan (Yin, 2003). (2) The semi-structured interview has a set of questions to be asked; however, the line of questioning may be modified to give the respondents the freedom to express their opinions and knowledge on a subject matter (Robson, 2002). (3) Structured interviews, however, are geared towards gaining specific information, that is, to gain confirmation or otherwise about information that is already known. Structured interviews apply a set of specific questions to achieve the research objective (Sekaran, 2003).

In view of this, the semi-structured interview allows the researcher to elicit responses to specific research questions, while also allowing for free expression of thoughts by the subjects (Chenail, 2011). Therefore, semi-structured interviews were used to delve into the subject matter, and it enabled the interviewer to probe for answers to great depth. Face-to-face interviews were used based on the research's review of the concept of value leaks (Sekaran, 2003; Robson, 2002).

- **Interview procedure**

Prior to conducting the interviews, the interview guide, together with the information sheet which entailed the purpose of the study, rights to participate, benefits of the study, confidentiality, and data protection were sent to the participants via email and all their doubts were addressed on the phone.

Due to the busy schedules of these senior project management practitioners, which included frequent site visits and regular meetings, it took approximately one month before the researcher could interview the first participant, after addressing their doubts on the telephone, and a maximum of two months to complete the rest.

All the interviews were conducted after working hours between the hours of 6 pm and 8 pm to avoid the interruptions which might have arisen during working hours. Four interviews were conducted in their executive corporate offices and two at a paid venue outside their working premises. With the participants' consent, the researcher used a voice recorder to record the interview proceedings. The duration of the interviews ranged from 47 minutes (shortest) to one hour and 22 minutes (longest)

3.3.1.4 Qualitative data analysis techniques

The study used the qualitative computer data analysis program Atlas.ti to code the data for analysis, as manual coding is considered to be a laborious and time-consuming process, and using such a program is a faster and more efficient way of storing and locating qualitative data (Creswell, 2014). The study utilised the steps outlined by Creswell (2014) in analysing the qualitative data as explained below.

To begin with, organise and prepare the data for analysis. The raw data was obtained from the interview through memos, write-ups and audio recordings. The raw data obtained from the interviews was transcribed into a word file and shared with the participants to confirm whether their thoughts and ideas were well captured. The data was sorted and arranged in a table form, based on the question number, label, description of questions and answers. Bazeley (2013) explained that organising data for analysis involves preparing files, considering secure storage of the files, as well as selecting the method of analysis.

The next step involved reading through all the data. Creswell (2014) explained this step as gaining an overall sense of the information and a chance to reflect on its complete meaning, overall depth, credibility and the information usage. After carefully reading through the transcription of the raw data, it was observed that not all the information gathered could be used due to the issue of relevance. The study therefore used the “winnow” strategy proposed by Guest, MacQueen and Namey (2012), which allowed the researcher to focus only on the data relevant to the study and to discard those of less importance. Based on the ideas of some codes gained from the winnowing, data was subjected to the coding process.

The next step was to start coding all of the data. The study organised the data by segmenting sentences into categories, and classifying these categories, to generate descriptions and themes through open coding, based on the commonality and uniqueness of participants’ responses (Creswell, 2014; Rossman & Rallis, 2012). This involves the number of codes (grounded), quotations (density), objects linked to the codes (network), and groups and subgroups in the data.

In line with ethical considerations, the companies and interviewees were provided with the pseudonyms: **A** to **D**, and **D1** and **D6** to maintain their anonymity, as shown in Table 4.1 in Chapter 4. At this stage, the mistakes made during coding were identified and corrected. This included renaming codes, unlinking quotes from codes, and deleting wrong codes.

The next step involved interrelating themes/description. Creswell (2014) explained that a study must indicate how descriptions and themes would be represented in the qualitative analysis. In view of this, the resulting effect was that researcher developed the themes into a theoretical model, as argued by Miles, Huberman and Saldana (2014), that the researcher should not be limited by the format to display the outcome, but should innovate that which works best for the study.

In this view, the researcher presented the descriptive information from the participants in his developed models: “Model-Cages”, “Value Leaks-Flashlight” with an add-on “Value Leaks-Tolerable Nut”, and Diagnostic Model as shown in the subsequent chapters.

The last step: interpreting the meaning of themes/description. The study interpreted the meaning of themes by carefully deciding what makes sense in the themes and the categories produced from the analysis, as asserted by Bazeley (2013). The findings are presented in Chapter 4.

3.3.1.5 Qualitative research reliability and validity

Creswell (2014), Freeman, Demarrais, Preissle, Roulston and Elizabeth (2007), Onwuegbuzie and Johnson (2006), and Tobin and Begley (2004) outline some procedures to ensure the credibility, dependability, authenticity, and validity of qualitative research data.

Data credibility can be achieved through efficient note-taking and transcription (Creswell & Miller, 2000). Moreover, data could be biased if the research subjects do not have a proper understanding of the questions being asked. This calls for skilled interviewing during the data-collection process. Additionally, expert opinions could be solicited (for example, through market researchers of focus group moderators) to aid the elicitation process (Sekaran, 2003).

As an extra measure, the current study averted bias by making certain of the triangulation of methods to obtain the same data from various sources (Creswell, 2014; Nunan, 1999; LeCompte & Goetz, 1982). In view of this, the interview guide was first shared with the participants, who individually decided on a convenient time for their interview. This gave them enough time to prepare for the interview and any clarification sought was dealt with. The same set of questions was used to collect data from three different sources.

The dependability of a research process infers stability and consistency. That is, the ability of a study to produce reliable methods which are coherent, and more importantly, can serve as a reference for future research. To achieve a reliable research approach, Yin (2012) proposed that researchers document all steps taken in the life cycle of a study. In this study, the researcher has elaborated on the procedure followed to undertake the research under the methodology section.

The authenticity of interviews begins with the preparation of questions which are grounded in literature. These question items must first be piloted before the actual interview is carried out. Piloting of the interview questions allows for the researcher to adjust the instrument in the event that some correction is required. It also ensures that researchers familiarise themselves with the material, and that they address vagueness in question items when they arise (Calitz, 2009; Berg, 2001). In effect, the authenticity of a study would ensure that the design of questionnaires is well grounded in theory, while making certain that the interviewing process is unbiased (Gibbs, 2007).

The interview guide that was used in the current study was developed out of grounded literature and subjected to subject area experts' perusal. A few corrections were made after the experts' consultation before seeking permission from the UNISA Ethical Review Committee to conduct the interviews (see Appendix 1 and 2).

According to Gibbs (2007), a qualitative study can be reliable when the data is devoid of transcription errors, coding definition is consistent and well interpreted by researchers. This can be achieved through a rigorous audit of the research process before, during and after data analysis (Onwuegbuzie & Leech, 2007; Tobin & Begley, 2004).

In particular, the study solicited the assistance of an independent co-coder to rerun and validate the findings. Also, an external reviewer was sought to review the study in terms of the quality and consistency of the results in meeting the research needs (Creswell, 2014).

3.3.2 Quantitative research: Phase 2

This research sought to verify and build on the findings from the qualitative research by identifying and assessing the relationship among variables (Creswell, 2014). Thietart (2007) described quantitative research as a technique which employs the use of statistical analysis and numerical values to provide quantitative information using a questionnaire.

Babbie and Mouton (2010) argued that the population for the quantitative research must clearly be defined. The quantitative data for this study was accomplished according to the structure discussed below.

3.3.2.1 Survey strategy

According to Saunders *et al.* (2012), a survey strategy is generally associated with the deductive approach which is mostly used to respond to questions in the form of 'who', 'what', 'where' and 'how'. Saunders *et al.* (2012) further asserted that the questionnaire is the most common data-collection method used in surveys, since it ensures the collection of a great amount of data from a substantial population size in the most cost-efficient manner in its administration. In addition, a survey sample is generally drawn from a population which is known to the study, and a structured questionnaire is utilised.

With regards to this, the study used structured questionnaires to collect data which was eventually examined statistically. The main consideration for using a structured questionnaire was that it guided the participants to give swift responses and speed up the coding and analysis process (Rowley, 2014).

3.3.2.2 Target population, sample size and sampling technique

The population of a study is explained as the quantity of units (individuals, organisations) or set of cases from which samples are taken for measurement (Saunders *et al.,* 2012; Taherdoost, 2016). Bartlett, Kotrlik and Higgins (2001) made a distinction between the target and accessible population. Whereas the former constitutes a group of individuals with specific traits relevant to a study, the latter focuses on individuals in the target population who can be reached for needed information. The accessible population is also termed as the sampling frame, from within which the actual elements are sampled (Taherdoost, 2016). Al Kindy, Ishak Mad Shah and Ahmad Jusoh (2016) explained sample size as a subset of a population, and sampling technique as method of selecting items or elements from a population.

In this context, the study firstly defined the target population as the companies within the telecommunication industry in Ghana which undertake cell site rollout projects, and secondly, the accessible population was defined as the individual employees within these companies who have direct project management responsibilities on cell site rollout projects. In line with this, there are four (4) mobile network operators in Ghana and three (3) mandated tower companies in Ghana (NCA, 2019) which undertake cell site rollout projects (Osei-Owusu & Henten 2017). There are also two (2) key managed-service vendors that serve as contractors to these MNOs to rollout cell site projects. Therefore, a total of possible nine (9) companies in the telecommunication industry in Ghana served as the target population for the study.In determining the sample size for the target population, there are four (4) main strategies that are commonly employed. These are the use of census for a small population, copy a sample size of similar studies, using published tables, and using formulae to calculate a sample size (Saunders *et al.* 2012, Gill & Johnson, 2010; Sekaran, 2003; Krejcie & Morgan, 1970; Cochran, 1963).

In view of this, a target population with possible nine companies warranted a census study, however, out of the nine (9) companies, the study used a convenience sampling method to select eight (3 out of 4 mobile network operators, all 3 tower companies and 2 key managed-service vendors) as the sample size for the study. This was owing to the ninth company's lack of easy accessibility and unwillingness to participate in the study as asserted by Etikan *et al.* (2016). With this assertion, Etikan *et al.* (2016) argued that convenience sampling is commonly used in quantitative research and requires a description of the elements excluded from the selection process, as it ensures that the information obtained can be a fair representative of the target population. In line with this, the excluded company had the lowest contribution of 1.76% in terms of market share and cell sites deployment in the Ghanaian telecommunication industry (NCA, 2019; Osei-Owusu & Henten, 2017).

Consequently, the knowledge gained from the selected companies could be considered as more than enough to represent the target population. The names of the eight companies were provided with the pseudonyms **A** to **H** to maintain their anonymity. In line with a sample size for the accessible population, the study used a simplified formula for proportions that was originally developed by Yamane (1967, cited in Islam, 2018), and which was also considered to be among the most commonly used formulae to determine the sample size for a study, and it is illustrated as follows:

$n = N/ 1+ N(e^2)$ where n = sample size; N = known population; and e = level of precision

With a given total number of 350 employees within the selected companies; the breakdown is shown in Table 3.2, the study therefore assumed a 5% significance level with a population proportion of 50%, and the accessible population sample size was determined as 350/1+320(0.5) ^{2} = **187.** With the application of factor analysis as a technique for statistical analysis, Patel (2015) argued that the recommended minimum sample size should be 50, but preferably the sample size should be 100 or more, therefore, a sample size of 187 for the accessible population seemed an appropriate number for factor analysis.

In sampling 187 individual employees within these companies who have direct project management responsibilities on cell site rollout projects, the study used a proportionate stratified random sampling technique. This meant that the accessible population was first divided into subgroups (companies), and the employees were then drawn in proportion to their original numbers in their companies via simple random sampling technique without replacement (Sekaran, 2003), as illustrated in Table 3.2. The reason for this sampling technique was that it is considered the most efficient technique among all probability sampling designs, and ensures that all subgroups are adequately sampled (Sekaran, 2003).

Table 3.2: Sampling in the accessible population

Company	Provided number of staff	Proportionate sampling
Company A	52	28
Company B	66	35
Company C	37	20
Company D	51	27
Company E	52	28
Company F	30	16
Company G	28	15
Company H	34	18
Total	**350**	**187**

NB: Company B = 66/350*187 = 35

With the intent of achieving the desired level of responses, since factor analysis is sample size sensitive (Patel, 2015), the study over-recruited by administering a total of 230 questionnaires, with the expectation of achieving an 81% response rate to meet the 187-sample size required. Islam (2018) opined that in recent times, researchers over sample by 5% to 20% to achieve the desired level of control over non-participation. Besides, in quoting Israel (1992), Islam (2018) argued that sample size could also be increased by 30% to make provision for no responses. Therefore, the over-recruited sample size was computed as shown below, and administered in proportion to each company's required sample size as determined for the study.

$$\text{Sample size (over-recruited)} = \frac{\text{Targeted number of final respondents}}{\text{Expected response rate}}$$

Sample size (over-recruited) = 187/ 81% = **230** respondents

3.3.2.3 Data-collection technique

A total of 230 questionnaires were administered by the hand delivery of hard copies with the help of representatives in each company. The questionnaires comprised Likert-scale measurements based on a 5-point rating system (Sekaran, 2003) (see Appendix 3). The study's use of Likert scales facilitated the categorisation of question items and standardised responses, which eased the data analysis process. Moreover, employing Likert-scale in this study helped to:

- determine the value leaks' causal factors and sources, and to examine the strength of the impact of sources of value leaks' causal factors on project performance success with anchors such as: Strongly Disagree=1; Disagree =2; Neither Agree nor Disagree =3; Agree = 4; Strongly Agree =5
- determine the rate at which causal factors contribute to value leaks with anchors such as: Never =1; Rarely =2; Sometimes=3; Frequently=4; Always=5

Subsequently, the collected responses were analysed using the IBM SPSS/AMOS software programs.

3.3.2.4 Quantitative data analysis

The study used both univariate and multivariate data analysis techniques in achieving the purpose of the study via IBM SPSS and AMOS version 25.0. Among the specific techniques used was descriptive analysis, in which frequency counts and percentages were utilised to assess the response rate, missing data, and normality. Also, correlation and regression analysis were performed to establish the correlation coefficients between the constructs and multicollinearity, linear association between the measures of value leaks, project measuring criteria, and cause-and-effect relationships among the causal factors and value leaks occurrence. Finally, exploratory factor analysis (EFA), confirmatory factor analysis (CFA) and structural model were carried out to minimise the data and achieve the overall objectives of the study based on a correlation or covariance matrix (Kline, 2016).

Some of the data analysis techniques applied in the study are discussed below.

Descriptive analysis

This was used to describe the essential characteristics of the study's data. Sarmento and Costa (2019) opined that descriptive analysis enables large amounts of data to be simplified in a sensible way and makes presentation of quantitative descriptions in a more appropriate manner. The study therefore used frequency distribution (frequencies and percentages), measures of central tendency (means) and measures of variability (variance and standard deviation) to generate and represent the results' response rate, data screening, demographic profile and distribution in a table form. Sarmento and Costa (2019) further asserted that each descriptive statistic lessens several numbers of data into an abridged version for analysis.

Testing of multivariate analysis for factor assumptions

According to Bryne (2010), the structural equation model (SEM) analysis is well founded prior to its commencement, when the assumptions of multivariate analysis ensued. Patel (2015) asserted that normality tests with the Skewness and Kurtosis test, and Multi-collinearity tests are considered to be the key assumptions underlying factor analysis applications. In addition, Koyuncu and Kilic (2019) emphasised that the ability to choose an appropriate rotation method as well as parameter estimation method for factor analysis, multivariate normality test and multicollinearity test should not be violated, as discussed below.

- **Normality test**

  According to Hair, Anderson, Tatham, William and Black (2010), data normality shows the shape of data distribution for the variables in the study. In determining data normality, the study used the Skewness and Kurtosis test as asserted by

Mishra *et al.* (2019) and Patel (2015) as it is a popularly used method to measure data normality. Bashir and Hassan (2018) and Kim (2013) suggested that the values of Skewness and Kurtosis must fall within range of ≤ 2 and ≤5, respectively, to showcase the normal distribution of the data.

- **Multi-collinearity test**

  Daoud (2017) accentuated that prior to the commencement of the data modelling process, multicollinearity-related issues should be resolved first, because is considered as one of the biggest issues in quantitative research. Also, Daoud (2017) explained multicollinearity as when two or more independent variables are highly correlated. Kline (2016) also added that multicollinearity shows the level to which a variable in a study is explained by others. Hair *et al.* (2010) opined that two generally used measures to determine multicollinearity are tolerance and the variance inflation factor (VIF). While, VIF shows a degree of variability that a variable is explained by other variables, tolerance is the opposite of VIF (Bashir & Hassan, 2018). To establish the non-violation of the multicollinearity assumption in a study, Kline (2016) and Hair *et al.* (2010) suggested that VIF value should be < 10 and the tolerance value should be > 0.10.

Exploratory factor analysis (EFA)

This is a statistical technique used to reduce a large set of variables by describing the variability among the observed and correlated variables (Sarmento & Costa, 2019). With reference to the findings from the qualitative study, several factors were identified and grouped under some dimensions in line with objectives 1, 2, 3 and 4 of the study. Thus, the study sought to firstly, identify factors that cause value leaks during project management within the set of observed variables; secondly, quantitatively examine the retained factors' contribution to the occurrence of value leaks during project management; and thirdly, determine the retained factors from different sources' contributions to the occurrence of value leaks, and finally, to develop a value leaks diagnostic model.

This classification therefore formed a strong conceptual foundation as the rule of thumb for EFA requires, hence, the adoption of EFA. As argued by Brown (2015), EFA is adopted when the aim of the study is to determine the ideal number of factors, and to ascertain whether strong correlations exist between the measured variables. The findings after the confirmatory analysis culminated in the development of the value leaks diagnostic model.

In order to run EFA, Patel (2015) developed a procedure which consists of the following four key stages: (1) conceptual consideration, (2) appropriateness of data for factor analysis, (3) method of factor analysis, and (4) extraction, interpretation and naming the factors, as briefly discussed below.

- **Conceptual consideration**

  This can also be termed as sampling adequacy, and in view of this, Patel (2015) recommended that a minimum sample size for EFA should be 50, but preferably the sample size should be 100 or more, and must have more observation than variables. With a sample size of 230 and each factor with a minimum of 20 observations, this study was suitable for EFA per Patel's assertion.

- **Appropriateness of data for factor analysis**

  This can also be considered as suitability analysis. In addition to establishing the sampling adequacy, Koyuncu and Kilic (2019) argued that it is important to determine whether the data is fit for EFA, and in line with that, Kaiser-Meyer-Olkin (KMO) and Bartlett's test of sphericity had to be analysed. Koyuncu and Kilic (2019), in quoting Hair *et al.* (1995) and Tabachnick and Fidell (2012), further stressed that the KMO value should be greater than 0.50, and Bartlett's test of sphericity must also be significant at $p < 0.05$.

  Nevertheless, Sarmento and Costa (2019) argued that KMO values between 0.8 and 1 show sampling adequacy. In citing a rule of thumb by Kaiser (1958), Sarmento and Costa (2019) considered KMO values between 0.70 to 0.79 as "middling"; 0.80 to 0.89 as "meritorious", and 0.90 to 1.00 as "marvellous".

- **Method of factor analysis**

  Koyuncu and Kilic (2019) opined that selecting an appropriate factoring method for EFA is essential for assessing the validity of the factor structure observed, and therefore, the Maximum Likelihood Estimate (MLE) was used as a method of factor analysis, among other methods.

The adoption of MLE was based on its assumption that correlation results from a population with a multivariate normal distribution (Sarmento & Costa, 2019) and since the test of normality ensued in the study, it was therefore appropriate for both EFA and CFA.

- **Extraction, interpretation and naming the factors**

Sarmento and Costa (2019) argued that prior to the analysis of factors, it is imperative to find out the number of factors to be kept. In quoting Hayton *et al.* (2004), Sarmento and Costa (2019) opined that the decision on the number of factors to retain can affect the EFA results, and errors concerning factor selection can massively change the solution and interpretation of the EFA results.

Koyuncu and Kilic (2019) asserted that among the methods to decide upon the number of factors to retain are the Kaiser criterion (eigenvalues > 1), Scree test, and parallel analysis. However, Warne and Larsen (2014), in referencing critics of the Kaiser rule, affirmed that strict usage of the Kaiser rule can result in several factors' retention, particularly when large number of variables are involved. Also, the Scree test may be equivocal and problematic to interpret when some cases show quite a lot of drops, and it may be difficult to determine the point of inflexion and likely cut-off points (Sarmento & Costa, 2019).

Therefore, Sarmento and Costa (2019) suggested that these methods must be used alongside other methods. In view of this, the study therefore used the parallel method, in addition to the Kaiser criterion and Scree plot methods to mitigate the issues of obtaining several factors for retention with the Kaiser criterion, and to avoid the confusion of interpreting cases which show quite a lot of drops and likely cut-off points. The parallel analysis (PA) as eluded to by Warne and Larsen (2014), compares each observed eigenvalue to the 95th percentile of the equivalent eigenvalue for the random datasets.

Although parallel analysis is not accessible in SPSS, the study used SPSS and the SAS syntax developed by O'Connor (2000) to decide on the factors to retain. In deciding on the factors to retain, the Promax with Kaiser Normalisation rotation method was used to reduce the number of items with high loadings to more than one factor (Yong & Pearce, 2013). With regards to factor loadings, Patel (2016) explained that factor loading ± 0.50 or more are termed as practically significant.

Therefore, items with factor loadings less than 0.50 would be dropped or deleted from further analysis.

The quality of the factor model must be analysed, and the most commonly used technique is the Cronbach alpha coefficient; which measures the degree to which the items in the dataset are correlated (Sarmento & Costa, 2019). Patel (2015) therefore recommended that the Cronbach alpha coefficient must be >0.70, however, a 0.60 level can be considered in exploratory factor analysis.

Lastly, the naming of factors is considered as the last stage of EFA (Koyuncu & Kilic, 2019). Prior to this, Henson and Roberts (2006) asserted that each factor should have a minimum of two or more items on it. Therefore, Yong and Pearce (2013) explained that although no stipulated rule governs factor naming, factors should be named with respect to that which represents them best.

Confirmatory factory analysis and structural equation modelling

In confirming the achievement of Study objectives 1, 2, 3, and 4, structural equation modelling (SEM) was conducted as a confirmatory, instead of exploratory, approach to data analysis (Asoka, 2015). According to Xie (2011), in social research, especially in a quantitative study, SEM has been generally espoused as it allows for the modification and assessment of theoretical models. Asoka (2015) asserted that SEM can be categorised into a measurement model and a structural model, whereas the former, which is also known as confirmatory factor analysis (CFA) indicates the relationship between observed variables and latent variables, the latter indicates the relationship between latent variables. Bryne (2010) asserted that CFA testing before structural model testing is the two-stage process of modelling in SEM, as discussed below.

- **CFA testing (measurement model)**

Orçan (2018) asserted that CFA is used to test the validity of the structure obtained after EFA. The same data used in EFA can be used for CFA, after the exclusion of low factor loadings. In view of this, only factor loadings greater than 0.50 were further examined with CFA to achieve Study objectives 1, 2, and partially 3, 4.

According to Brown (2015), among the steps involved in performing CFA, are model definition, data readiness for analysis, model parameter estimation, evaluation and conclusion. Koyuncu and Kilic (2019, quoting Cabrera-Nguyen, 2010) asserted that defining the model must be accurately done, and more than one fit index must be used with factor loadings together with significance values, the modification reasons must be explained, and the parameter estimation method used must be proper.

Koyuncu and Kilic (2019) argued that in making data ready, and to be able to choose an appropriate parameter estimation method, multivariate normality and multicollinearity should be checked. With respect to the parameter estimation method, Koyuncu and Kilic (2019) argued that the Maximum Likelihood Estimation (MLE) and Least Square (LS) are the most commonly considered methods in CFA. Whereas, the latter is utilised when the data is categorical, and the assumption of normality is violated with a small or medium sample size, the former is preferred when the sample size is large with continuous variables and a multivariate normal distribution of variables ensued.

In view of this, the study used MLE as the estimation method in conformance with EFA, since multivariate normality was not violated but ensued. Also, items which had factor loading less than 0.50, as well as items that showed obstruction to achieving model fit were all deleted from the measurement model through observation from factor loadings, extreme standardised residual values and path estimates.

Modifications were performed to achieve a model fit, as much as necessary, as recommended by Hair *et al.* (2010). The study also adopted indices, such as the absolute fit indices, parsimonious indices, and comparative indices to assess the overall model fit.

- **SEM testing**

In order to fully achieve Study objectives 3 and 4, the study adopted a structural model to determine the retained factors from the different sources' contribution to the occurrence of value leaks, as well as testing the conceptual model emanating from the literature review. Bryne (2010) asserted that SEM is designed to evaluate how well a proposed conceptual model could fit a set of collected data, and examine the structural relationships between the latent variables. Therefore, the structural models were produced and computed through MLE procedures using

SPSS 25 and AMOS 25. The adopted indices to assess the overall fit are discussed in Table 3.3.

- **Model fit indices for CFA (measurement model) and structural model**

In determining model fit, Brown (2015) categorised fit indices into the following three indices:

- absolute fit indices (x^2, SRMR ve RMR),
- parsimonious fit indices (RMSEA), and
- comparative fit indices (CFI-IFI, TLI-NNFI).

Brown (2015) suggested that a study should report at least one index from each category. Similarly, Asoka (2015) asserted that determining absolute model fit criteria generally involved chi-square (χ^2/sd), the Goodness of Fit Index (GFI), the Adjusted Goodness of Fit Index (AGFI), Root Mean Square (RMR), and Root Mean Square Error of Approximation (RMSEA). In line with this, the study used the indices outline in Table 3.3, to assess the overall model fit for both the CFA and the structural model.

Table 3.3: Summary of model fit indices and acceptable values

Fit indices Statistics	Acceptable values interpretations	References
Absolute Fit Index (χ^2/df)	≤ 5.0 or 1.0 - 4.0	Rosseni (2014), Kline (2011), Hair *et al.* (2010)
Goodness of Fit Index (GFI)	> 0.90	Hair *et al.* (2010), Hooper *et al.* (2008)
Adjusted Goodness of Fit Index (AGFI)	> 0.90	Hair *et al.* (2010), Hooper *et al.* (2008)
Incremental Fit Index (IFI)	> 0.90	Kline (2011), Hair *et al.* (2010), Marsh & Hau (1996)
Tucker Lewis Index (TLI)	> 0.90	Hair *et al.* (2010), Gaskin (2012), Hu and Bentler (1998,1999)
Comparative Fit Index (CFI)	> 0.90	Rosseni (2014), Hair *et al.* (2010), Hu and Bentler (1999)
Normed Fit Index (NFI)	> 0.90	Bryne (2011), Kline (2011), Hooper *et al.* (2008)
Root Mean Square Error of Approximation (RMSEA)	< 0.08	Rosseni (2014), Kline (2011), Hair *et al.*, (2010)
Root Mean Square (RMR)	≤ 0.050	Kline (2011), Hair *et al.* (2010), Shumacker (2010)

(i) Absolute fit indices

- *Chi-square statistics*

The chi-square test value (χ^2) is proportional to the degree of freedom (*df*), which assesses the overall fit value of the model, thus; (χ^2/sd) must be ≤ 5 or between 1 and 4. Also, the probability value, p-value must be non-significant probability levels, p-value > 0.05 (Asoka, 2019; Rosseni, 2014; Kline, 2011; Hair *et al.*, 2010). Some researchers argue that χ^2/sd criterion is sample size sensitive and should not be solely used as a good criterion to assess model fit (Asoka, 2015; Koyuncu & Kilic, 2019). In this view, several indices have been adopted in addition, to assess the overall model fit.

- *Goodness-of-Fit Index (GFI) and Adjusted Goodness-of-Fit Index (AGFI)*

This explains how well the model fits a set of observations (Asoka, 2015). Hair *et al.* (2010) explained the value for GFI as using the real data in relation to squared residuals and predictions, and AGFI is altered to the degree of freedom. Both GFI and AGFI should be > 0.90 to show a good model fit (Hair *et al.*, 2010; Hooper *et al.*, 2008).

- *Root Mean Squared Residual (RMR)*

In view of RMR, Hair *et al.* (1998) explained it as the square root of the mean of the residuals between the observed variables and the estimated metrics. The RMR value should be as low as possible (Tabachnick & Fidell, 2012). Shumacker (2010) argued that the researcher must define the level, therefore, and for the purpose of this study, RMR should be ≤ 0.05.

(ii) Parsimonious indices (Root Mean Square Error of Approximation, RMSEA)

Hair *et al.* (2010) explained RMSEA as factoring degrees of freedom into assessing how the model fit the population covariance matrix. RMSEA should be ≤ 0.080 (Rosseni, 2014; Kline, 2011; Hair *et al.*, 2010).

(iii) Comparative indices

- *Normed Fit Index (NFI) and Incremental Fit Index (IFI)*

Bentler and Bonett (1980) opined that NFI shows a percentage increase in the model fit over the baseline of the independent model. Asoka (2015) explained IFI as an index which excludes chi-square in its actual form, but associates the chi-square value with a baseline model. In determining a model fit with NFI and IFI, the values of both indices should be > 0.90 (Bryne, 2011; Kline, 2011; Hair *et al.*, 2010; Hooper *et al.*, 2008; Marsh & Hau, 1996).

- *Tucker Lewis Index (TFI) and Comparative Fit Index (CFI)*

  TFI and CFI ensure a comparison of the absolute fit of a specified model to the absolute fit of an independent model (Asoka, 2015). The values of TFI and CFI should both be > 0.90 (Rosseni, 2014; Gaskin, 2012; Hair *et al.*, 2010; Hu & Bentler, 1999, 1998).

3.3.2.5 Quantitative validity and reliability analysis

Saunders *et al.* (2012) maintained that to ensure that a study can stand the test of time, it must focus on the validity and reliability of its research design. Thus, it is the reproducibility of the findings from a study. The study adopted the validity and reliability measures that are explained below.

Validity analysis

Saunders *et al.* (2009) indicated that validity looks at the findings of a study, whether they are as they seem to be. Herman (2010) explained validity as the level to which an item measures what it is designed to measure. Koyuncu and Kilic (2019) in referencing the American Psychological Association (APA), American Educational Research Association (AERA) and the National Counselling on Measurement in Education (NCME) (1974) asserted that the validity of a study is founded on content, construct and criterion.

- **Content validity**

  Creswell (2014) explained it as whether the items measure the content they are designed for. Also, Sekaran (2003) opined that content validity ensures that there are enough and a representative set of items that measure the concept. Koyuncu and Kilic (2019) affirmed that expert opinion is normally used to offer evidence on content analysis, nevertheless, the current study assessed content validity through inter-item correlations with a coefficient value less than 0.90 as a cut-off point, whereby item loadings greater than 0.90 with inter-item correlation above 0.80 were excluded. As such, the levels mean that each item provides less information to explain the factor. In addition, a Cronbach's alpha greater than 0.60 shows enough representation of items that measure the construct (Patel, 2015, Hair *et al.*, 2010).

- **Construct validity**

Kline (2016) affirmed that construct validity indicates whether test scores can measure a construct only by the items within the construct. Koyuncu and Kilic (2019) explained construct validity as the degree to which a construct is measured by a scale and factor loadings that should be ≥ 0.50 to exhibit factorability of the items on the construct (Hair *et al.*, 2010).

In view of this, Awang (2014) and Hair *et al.* (2014) asserted that convergent validity and discriminant validity are considered as the two topmost and extensively accepted and used methods of construct validity.

Convergent validity is explained as the level to which a set of observed variables converge on a construct and is assessed through an average variance extracted estimates (AVE) (Hair *et al.*, 2010). According to Fornell and Larcker (1981), AVE is calculated by (summation of squared factor loading) / (summation of squared factor loading) + (summation of error variances). Although, for constructs to show convergent validity, AVE estimates should be ≥ 0.50 (Hair *et al.*, 2010; Kline, 1998). However, Fornell and Larcker (1981) argued that constructs with AVE estimates little below 0.50, but that have a square root of AVE, (composite reliability, CR) estimates ≥ 0.60 should be considered as exhibiting convergent validity.

Discriminant validity is explained as the degree to which one construct or latent variable is distinct and unique from other latent variables or constructs within a model (Hair *et al.*, 2010). Discriminant validity enseus when the square root of AVE (composite reliability, CR) estimates are more than the correlation coefficient values, or when the correlation coefficient values are < 0.70 (Hair *et al.*, 2010, Fornell & Larcker, 1981). Koyuncu and Kilic (2019) therefore, concluded that factor analysis is the best way to showcase the factors that best explain a construct. In this regard, CFA was used to estimate and assess the convergent validity and discriminant validity of all the constructs in the study.

- **Criterion validity**

  Koyuncu and Kilic (2019, in quoting Cureton, 1951) asserted that criterion validity shows whether a test measures what it is planned to measure. Creswell (2014) also explained that criterion validity detected whether the instrument scores envisage criterion measures and the results can be compared to other results. Sekaran (2003) affirmed criterion validity as when the instrument differentiates individuals that the criterion expected to predict. To determine this, the study used concurrent validity to assess the construct consistent to the expectations, whereby the correlation coefficients should be significant at the $p < 0.01$ level which predicts the outcomes (Wong, 2002).

- **Unidimensional validity**

  Lopez, Peon and Ordas (2006) asserted that achieving an overall model fit for data constitutes the unidimensionality of the scale's usage. Also, Ya'acob (2008) added that for each parameter estimate, the critical ratio (CR) should be ≥ 2.00 and the statistically significant p-value < 0.05.

Reliability analysis

Reliability is a measure which shows the stability and consistency across the various items in the instrument without bias, and the internal consistency of measures reflect the homogeneity that exists within those measures (Sekaran, 2003).

Among the four methods asserted by Sekaran (2003), namely, the test-retest method, split half method, parallel or alternate form method, and Cronbach's alpha coefficient method, the latter has been considered to be the most practicable method to measure internal consistency within the items (Sekaran & Bougie, 2010).

Hence, the Cronbach alpha coefficient was used to test the reliability of the 5-point Likert scale in the questionnaires. Patel (2015) therefore recommended that the Cronbach alpha coefficient should be > 0.70, however, a 0.60 level can be considered in factor analysis. Moreover, a Cronbach's alpha greater than 0.60 shows strong correlation between the measurement variables (Saunders *et al.*, 2009).

3.3.2.6 Preliminary study or pilot test

According to Creswell (2014), pilot testing or field testing is essential to determine the content validity of scores on the questionnaire and to enhance the format, questions and scales. The purpose of pilot test is to ensure that items in the instruments can be administered shorn of variability to the target group. Bless, Higson-Smith and Kagee (2006) described a pilot test as a small study aimed at ascertaining the appropriateness and sufficiency of a research methodology, its instruments and analysis preceding the main research.

Prior to the commencement of data collection, the study ran pilot tests on six senior project managers, two from each company, A, B and C; who have direct responsibility of the rollout of cell sites within their respective companies that were included in the final sample. These participants were chosen based on their level of experience and knowledge as far as the subject matter was concerned and their willingness to assist the study to achieve its overall aim.

The main objective of the pilot study was to determine the clarity of the questions, format, length of time to complete the questionnaire, and the scale used via phone call and face-to-face reviews. After the receipt of these experts' feedback the researcher would be able to take the following steps: rephrase the questions which may be confusing, delete any problematic items in the questionnaire, and replace any item which would not contribute to the objectives of the study with regards to the subject area.

After sharing their opinions and suggestions on the items in the questionnaires, the initial estimated time to complete the questionnaire which was set to 25 minutes became 45 minutes. Also, all the participants but one indicated that the items in the questionnaires were really clear and straightforward and also meant to achieve the objectives of the study with respect to the subject area. The feedback from the other participant was about the arrangement of the items to follow a certain pattern for easy identification, which was considered to enhance the questionnaire for the study. However, none of the participants indicated any difficulty in understanding and completing the items in the questionnaire, although, they all acknowledged the packed nature of the questionnaire, but agreed that all the items were relevant for the study.

3.3.2.7 Data screening and preliminary analysis

Data screening and preliminary analysis is considered as very useful in detecting and addressing the possible violations of multivariate analysis assumptions. It also provides the study with better understanding of the quantitative data and allows for accuracy and consistency in data analysis (Kura *et al.,* 2014, as cited in Bashir & Hassan, 2018:123).

In order not to violate the assumptions of multivariate analysis, Bashir and Hassan (2018:123) asserted that among the key assessment of quantitative data are issues concerning response rate, missing values, data normality, and multicollinearity. Bashir and Hassan (2018) concluded that ignoring preliminary data screening affects the quality of inferences and conclusions drawn from the data. Albeit, the issues concerning data normality, and multicollinearity have already been dealt with under factor analysis.

a) Response rate

According to Won *et al.* (2017), the response rate is explained as the cohort of the respondents who actually answered the study's questions with regards to the sample size. In light of this, Bashir and Hassan (2018) in referencing previous studies, argued that a response rate to a study greater than, or equal to 30%, is considered acceptable for quantitative analysis. The study used descriptive statistics via frequency counts and percentages in SPSS version 24.0 to determine the response rate.

b) Missing data analysis

Won *et al.* (2017) asserted that missing data results from the participants' unwillingness to answer the items in the questionnaires or a data entry error made by the researcher, and these make the data inappropriate for analysis. Also, among the causes of missing data are respondent's refusal to respond to long questionnaires, issues of sensitivity, fatigue, lack of knowledge about the questions, lack of time to answer the questions, and data entry errors (Garson, 2008; Field, 2005).

In view of this, the study firstly ensured careful data entry and error identification to correct errors made by the researcher, and secondly, used the mean substitution method to replace the missing values resulting from the participants' failure to respond to the items in the questionnaires.

Bashir and Hassan, (2018) opined that missing data has no general percentage cut-off point, but some proponents, such as Hair *et al.* (2010), recommend that a missing value less than, or equal to 10%, should not pose a threat to statistical analysis.

The study used descriptive statistics via frequency counts and percentages in SPSS version 24.0 to ascertain the missing values.

- **Data capturing and identification of errors on SPSS**

  The items in the questionnaires were first captured onto the Statistical Package for Social Science, SPSS version 24. In the variable view, the items were vigilantly coded under the name column, and their respective names under the label column. Values under each item were defined whereby the missing values were denoted by 99 and measures (nominal, scale, and ordinal) under the measure column were defined accordingly.

  After the receipt of the questionnaires from the various companies, a serial number was first assigned to each questionnaire and all the responses were carefully entered onto the SPSS data view, based on the item's codes defined under the variable view. After the data entry onto the SPSS, multiple checks were done to correct any wrong entries.

- **Data imputation for missing values**

  Among the methods for data imputation for missing values, the average value imputation is considered as the most common and the best way of replacing missing values. It is obtained by calculating the mean from the quantitative data and ascribing these means for the variables that have missing values (Tabachnick & Fidell, 1996, as cited in Cokluk & Kayri, 2011).

  The study adopted the imputation method as it is the most popular and provides the researcher with the chance to analyse with a complete data set, as alluded to by Cokluk and Kayri (2011, referencing Huisman, 2000).

  The study therefore used the Series Mean option in SPSS to obtain such means for the missing values. Series Mean is the default in SPSS which calculates the means of all items associated with a particular variable (Mertler & Vannatta, 2005).

3.3.3 Ethical considerations

The ethical considerations relevant to the study are discussed in this section.

3.3.3.1 Right of the participation

The cover letter on the questionnaire and the information sheet with the consent form explained to the participants that participating in the study was voluntary and they were under no obligation to consent to participate. They could, however, refuse to participate at any time and even after giving their consent, they were allowed to retract their consent without providing any reason and this would not have any adverse effect. However, the importance of the study to the industry compelled them to consent to participating, as explicitly affirmed in the information sheet and summarised in the cover letter (see Appendix 2).

The study ensured integrity by obtaining an ethical clearance certificate from the Senate Research and Innovation Higher Degrees Committee (SRIHDC) of UNISA, and by obtaining permission from the selected companies (see Appendix 1 and 2).

To avoid undue pressure, the participants provided convenient dates for the interviews, and they were given a little over three weeks to complete the questionnaires, although the survey was estimated to take a maximum of 45 minutes to complete.

The study can confidently confirm that there was no data manipulation and the findings are reflective of the data collected.

3.3.3.2 Confidentiality

All the information gathered during the study was treated with the utmost confidentiality and participants were assured of being protected from all forms of identification at both personal and at institutional level. In this regard, participants' identities, such as names, roles, units or departments were not mentioned throughout the study. The names of the companies were provided pseudonyms with the letters **A** to **H**, making it difficult for easy identification.

Although with the qualitative study, the voices of the participants in the interview were recorded with their consent, it was just for analysis purposes. There was no disclosure of any information that could harm the participants neither was there any undue pressure that could cause participants to disclose company confidential information which might affect their employment.

In both studies, participants' answers were given code numbers which are referred to in this study and would be referred to in any publication. Participants were also assured that the University of South Africa conforms to relevant data protection legislation, and their details would not be disclosed to anyone.

The researcher avoided falsification of information or sources of data and gave a complete account of what transpired throughout the study. The study acknowledged the sources of information used in the study by crediting the works of others.

3.3.3.3 Management of the findings

The study prevented misuse of the findings to benefit one company at the expense of others. The study treated all participants with utmost respect, regardless of their company size or market share, age and gender.

The credibility of the study can be ascertained by following the details of the methodology and the research design provided. The hard copies of the data will be archived in line with University of South Africa's data protection and thesis publication procedures.

3.4 SUMMARY

This chapter presented an in-depth discussion of the research design and methodology used to carry out the research study based on the research objectives which are founded on the theoretical and literature review presented in the previous chapters. The study assumed a pragmatism worldview and adopted a mixed-method approach, specifically an exploratory sequential mixed method, which culminated in two phases. The first phase was the qualitative research, which used semi-structured interviews based on a multiple-case study strategy, and the second phase was the quantitative research, which used structured questionnaires based on a survey strategy. In both cases, the target population, sample size and sampling techniques, as well as data collection and analysis techniques, were extensively discussed. The research reliability and validity for both phases were addressed. The next chapter presents the findings from the qualitative phase of the study, followed by a discussion of the findings and recommendations.

CHAPTER 4:
QUALITATIVE DATA ANALYSIS AND PRESENTATION

4.1 INTRODUCTION

This chapter presents the findings from the interviews with senior project management practitioners within the telecommunication industry in Ghana. The topic of value leaks is considered an important issue in project management, and the ability to control or avert them can make or break a project's value success. As EVA is used to measure project performance, an integration of value leaks into EVA can aid in deriving greater value in project management. In line with this, the findings from the interviews are presented in accordance with the objectives of the study. As a preamble to the presentation, the findings begin with the presentation of the demographic information which explains how individuals with different dispositions and qualities responded to the interview questions.

As a multiple-case study, the study first analysed each of the four individual companies used and thereafter, performed a cross-case analysis with regard to the similarities and differences that exist among the companies regarding the objectives. Subsequently, the study presents the findings related to Objective 1: a critical analysis of value leaks' casual factors during project management, which lays the foundation for addressing the other objectives through quantitative analysis.

Through this objective, the study presents the findings on EVA as a measure of project performance, value leaks in site projects and the factors that cause value leaks. Furthermore, the study presents the findings related to Objective 3, namely, to explore the impact of different sources of value leaks (stakeholders, project life cycle, and environment) on project success. Finally, this chapter presents a summary of the qualitative findings as discussed.

4.2 DEMOGRAPHIC INFORMATION

This section sought to ascertain how individuals with different dispositions and qualities respond to the questions that address the objectives of the study. In line with this, the findings from the demographic analysis are presented bottom-up, as shown in Table 4.1.

Table 4.1: Summary of demographic information

Role in site rollout	Project Director	Project Manager	Project Manager	Project Manager	Project Manager	Project Team Member
Field of study	Finance	Project Management	Telecom Engineering	Telecom Engineering	Communication Management	Electrical Engineering
Highest level of education	Masters	Masters	Masters	Bachelor	Masters	Bachelor
# Years with the company	10 years	4 years	5 years	> 5 years	> 6 years	3 years
Previous positions	Telecom Engineer; Technical Director; Project Manager	Network Rollout Engineer; Customer Support Engineer; IN Manager	CS Core Performance; Optimisation & Planning Manager	Implementation Manager; Solution Manager	Transmission Engineer; Network Rollout Engineer	RF Planning & Optimisation Engineer; Performance & Quality Manager; Planning Manager
# Years in current position	5 years	> 2 years	3 years	> 4 years	> 4 years	3 years
Current position	Programme Director	Project Manager	Network Planning Manager	Project Manager	Network Planning Director	Head, RF Planning & Optimisation
Age	33	32	35	>35	40	35
Gender	Male	Male	Male	Male	Male	Male
Respondent designated code	#D3	#D4	#D5	#D1	#D2	#D6
Company code	**A**	**B**		**C**	**D**	

Source: Researcher’s construct from field data (2019)

Firstly, the study interviewed six (6) senior project management practitioners through purposive sampling from four (4) different companies in the telecommunication industry in Ghana. The intent was to gain the different companies' perspectives on the concept of value leaks, its associated causal factors and their sources, to enrich the achievement of the study's objectives.

In view of this, the study ascertained the respondents' gender, age, current positions, years served in the current position and role played in site projects in their current companies. This information has a strong bearing on how well the respondents would answer the interview questions in relation to their level of experience and knowledge of the problem.

In line with the study's ethical considerations, the companies and interviewees were provided with the pseudonyms **A** to **D,** and **D1** to **D6,** respectively, to maintain their anonymity, as shown in Table 4.1.

The findings showed that all the participants were male, and the majority of them fell within the age bracket of 32 to 35 years. With respect to the telecommunication organisational hierarchy; two (2) of the respondents were Directors, one (1) was a Head of a Unit, and three (3) were Project Managers, with an average three and a half years of working experience in the current position. Almost all the respondents played a lead role in cell sites projects, either as project manager or director. This implies that the respondents hold current information and knowledge about cell site deployment, and arguably, these respondents were found to be the most suitable for the study as they held the requisite managerial positions, as well as years in service in terms of site projects, as indicated in Table 4.1.

Furthermore, the study established the respondents' previous positions and number of years they worked in those positions. This historical information is important because the more experience a respondent has with cell site projects, the richer their level of understanding on cell site-related issues, influencing how well they answer the questions towards achieving the research objectives. The findings showed that the respondents had held a minimum of two different positions for at least three years, and these previous positions were linked to cell site deployment. This is an indication that the respondents are knowledgeable and have rich and practical experience in cell site project-related matters (see Table 4.1).

Finally, the study established the respondents' highest level of education and the field of study. This is significant as a person's level of education and the field of study could influence their responses to the interview questions. The findings showed that the majority of the respondents hold master's degree in relevant telecommunication programmes, while a few hold bachelor's degrees.

Therefore, having more master's and bachelor-degree holders helps to gain much clarity on cells site-related issues and enhances the quality of the study's findings. It is important to note that the study solicited information from knowledgeable persons with training in the field relevant to the telecommunication industry, as shown in Table 4.1.

4.3 EVA AS A MEASURE OF PROJECT PERFORMANCE

This section is extremely important to the achievement of the ultimate aim of the study, which is to propose the inclusion of value leaks into EVA as a measure of project performance through the development of the diagnostic model.

To this end, the study firstly established whether EVA is practically utilised in the telecommunication sector as a measure of project performance; and secondly, to appreciate how well the telecommunication project practitioners understand EVA and its application.

Table 4.2 illustrates the findings related to the main themes, key quotes, and key words from the participants. Also, the key elements derived from the narratives are exhibited in Figure 4.1 which serves as summary of the discussion on EVA culminating into the development of the diagnostic model.

Table 4.2: Summary of the quotes on Earned Value Analysis

EARNED VALUE ANALYSIS AS A MEASURE OF PROJECT PERFORMANCE							
INTERVIEW GUIDE QUESTIONS	**KEY QUOTES**	**COMPANY "A" KEY WORDS FROM NARRATIVE**	**COMPANY "B" KEY WORDS FROM NARRATIVE**	**COMPANY "C" KEY WORDS FROM NARRATIVE**	**COMPANY "D" KEY WORDS FROM NARRATIVE**	**ELEMENTS DERIVED FROM NARRATIVES**	**TRANSCRIPT REFERENCES**
Description of EVA as a measure of project performance	#D1. EVA measures project performance based on budget, time and scope as well as project specifications. #D2. This actually measures the performance of a project based on the three dimensions of project management: is it within cost, it is within time and it is within scope. The three dimensions that need to be controlled so it is not a matter of focusing on one aspect. Too much focus on one dimension then other two suffers so these three must be balanced. #D3. It measures project performance based on budget, time and scope. Once, you stay within budget, time and scope, we say the project performance is good. #D4. Earned value analysis is a common tool or technique we use in the industry. EVA is used for measuring my performance and reporting. Because you set out to deploy this site at this cost, and in your business case or justification, you have indicated by when the site will deliver value to you.	#D3. Budget, time and scope (specification); stay within; project performance is good (Transcript 1,3:60-61)	#D4. common tool or technique; cost, time and specification; measuring my performance and reporting (Transcript 3, 4:63-64) #D5. triple constraints; budget, schedule and scope (Transcript 2,5:70)	#D1. Budget, time and scope (Transcript 4, 1:59-60)	#D6. main indicators; the cost, the time and also the scope (Transcript 5, 6:50-51) #D2. within cost, it is within time and it is within scope; three dimensions; (Transcript 6, 2:49-50)	EVA is a common tool or technique used for measuring performance and reporting based on the triple constraints: budget, time and scope	Transcript 1,3:60-61/ Transcript 2,5:70 Transcript 3, 4:63-64 Transcript 4, 1:59-60 Transcript 5, 6:50-51 Transcript 6, 2:49-50

EARNED VALUE ANALYSIS AS A MEASURE OF PROJECT PERFORMANCE							
INTERVIEW GUIDE QUESTIONS	**KEY QUOTES**	**COMPANY "A" KEY WORDS FROM NARRATIVE**	**COMPANY "B" KEY WORDS FROM NARRATIVE**	**COMPANY "C" KEY WORDS FROM NARRATIVE**	**COMPANY "D" KEY WORDS FROM NARRATIVE**	**ELEMENTS DERIVED FROM NARRATIVES**	**TRANSCRIPT REFERENCES**
	#D5. EVA is based on the triple constraints. Measure yourself based on the budget you were provided to work with, based on your schedule and the cost assigned to each work package within a certain schedule, you would have estimated an amount of money to have spent. #D6. …the main indicators are; the cost, the time and also the scope. So, putting all these three together and meeting the target you set target for each of them actually gives you the value of your earned value.						
When amount of work done (earned value, EV) is less than the actual cost (AC) planned for that same amount of work? Thus; EV< AC	#D1. If the cost of work done is more than the actual work done, then it is gone over budget. #D2. That means that the project has gone over budget #D3. In this case, we will say that the earned value is less than the actual cost, in most cases we will say the project has gone over budget. #D4. Generally, it means I have outrun my budget #D5. In that instance and at the particular time of measure, your project is already over budget. Thus, when your actual spent is	#D3. Over budget (Transcript 1,3:62)	#D4. Outrun budget (Transcript 3, 4:66) #D5. over budget (Transcript 2,5:72)	#D1. over budget (Transcript 4, 1:8)	#D6. over budget (Transcript 5, 6:52) #D2. over budget (Transcript 6, 2:51)	EV< AC means over budget	Transcript 1,3:62 Transcript 2,5:72 Transcript 3, 4:66 Transcript 4, 1:61 Transcript 5, 6:52 Transcript 6, 2:51

EARNED VALUE ANALYSIS AS A MEASURE OF PROJECT PERFORMANCE							
INTERVIEW GUIDE QUESTIONS	**KEY QUOTES**	**COMPANY "A" KEY WORDS FROM NARRATIVE**	**COMPANY "B" KEY WORDS FROM NARRATIVE**	**COMPANY "C" KEY WORDS FROM NARRATIVE**	**COMPANY "D" KEY WORDS FROM NARRATIVE**	**ELEMENTS DERIVED FROM NARRATIVES**	**TRANSCRIPT REFERENCES**
	more than the earned value, it means that the project has gone over budget at the time of measure #D6. What this would mean is that you are heading towards missing or going over your budget.						
When amount of work done (earned value, EV) takes longer than the planned duration for that same amount of work? Thus; EV < PV	#D1. This is a delay #D2. This means that the project is delayed, and you are unable to realise the value. #D3. the project has delayed #D4. If the work done is less that the value you have initially planned then the work is delayed, in this case, it means that the site rollout is delayed #D5. Project could be behind schedule #D6. What it means is that you have missed your timeliness, the project would delay, and you could have an implication on you cost as well	#D3. Project has delayed (Transcript 1,3:66)	#D4. Site rollout is delayed (Transcript 3, 4:69) #D5. Behind schedule (Transcript 2,5:71)	#D1. Delay (Transcript 4, 1:64)	#D6. Missed timeliness; cost implication, (Transcript 5, 6:113) #D2. Project delayed; unable to realise value (Transcript 6, 2:54)	EV< PV means delay or behind schedule	Transcript 1,3:66 Transcript 2,5:71 Transcript 3, 4:69 Transcript 4, 1:64 Transcript 5, 6:113 Transcript 6, 2:54

Source: Researcher's construct from field data (2019)

4.3.1 Case analysis Company A – D

Company A

The findings from the enquiry into how well EVA is known and utilised, suggests that the project management practitioners in this company have some basic knowledge about it, as demonstrated by **#D3,** the Programme Director: "*It measures project performance based on budget, time and scope. Once, you stay within budget, time and scope, we say the project performance is good".* Also, his ability to provide the dimensions of EVA such as cost, time and scope is clear indication of his knowledge. In terms of the application of EVA, over budget is the response to an assessment of a situation where the amount of work done (earned value, EV) is less than the actual cost (AC) planned for that same amount of work, and this further supports the participant's knowledge of EVA as he stated: "*in most cases we will say the project has gone over budget".* Similarly, the participant's response "*the project has delay"* to an assessment where the amount of project work done took longer than the planned duration for that same amount of work further indicates an awareness of EVA in the company (see Table 4.2).

Company B

In this case, the evidence as shown in Table 4.2, suggests that the participants are familiar with the EVA technique and it is a common tool used in their project performance and reporting, as opined by both **#D4** and **#D5**:

> **"***Earned value analysis is a common tool or technique we use in the industry. EVA is used for measuring my performance and reporting. Because you set out to deploy this site at this cost, and in your business case or justification, you have indicated by when the site will deliver value to you."* (Project Manager)

> *"EVA is based on the triple constraints. Measure yourself based on the budget you were provided to work with, based on your schedule and the cost assigned to each work package within a certain schedule, you would have estimated an amount of money to have spent."* (Network Planning Manager)

In addition, the participants' responses to situational assessments on project work done costing more than its planned cost for that same amount of work confirms their knowledge of the application of EVA, as **#D4** stated *"Generally, it means I have outrun my budget"* and affirmed by **#D5**:

> *“In that instance and at the particular time of measure, your project is already over budget. Thus, when your actual spent is more than the earned value, it means that the project has gone over budget at the time of measure.”*

Their reactions to a situation where project work takes a longer time to complete than its initial planned duration suggest that EVA is indeed utilised in this company, as **#D4** opined: “*If the work done is less that the value you have initially planned then the work is delayed, in this case, it means that the site rollout is delayed*”, and **#D5** stated that *“Project could be behind schedule.*”

Company C

In this case, **#D1**, Project Manager, explained that EVA measures project performance based on budget, time and scope, as shown in Table 4.2. Also, the participant responded “*if the cost of work done is more than the actual work done, then it is gone over budget”* to a situational case where project work done costs more than its planned cost for that same amount of work. This is suggestive of his knowledge about the application of EVA. In the same vein, in his response; *“this is a delay”* to a situation where project work done takes longer time to complete than its initial planned duration, further confirms the awareness of EVA and its application.

Company D

The findings suggest that there is an understanding of EVA in this case because it is considered to measure the performance of a project based on the three (3) dimensions: within cost, within time and within scope, as alluded to by **#D2** and **#D6:**

> *“This actually measures the performance of a project based on the three dimensions of project management: is it within cost, it is within time and it is within scope. The three dimensions that need to be controlled so it is not a matter of focusing on one aspect. Too much focus on one dimension than other two suffers so these three must be balanced.”* (Network Planning Director)

> *“The main indicators are; the cost, the time and also the scope. So, putting all these three together and meeting the target you set target for each of them actually gives you the value of your earned value”* (Head, Radio Frequency Planning & Optimisation).

The situation where project work done consumed more budget than its initial estimated budget is considered as over-budget. In view of this, **#D2** stated: “*That means that the project has gone over budget”,* and **#D6** opined that *“what this would mean is that you are heading towards missing or going over your budget”*. Similarly, project work is considered delayed when more time is taken to complete it than its planned duration, as **#D2** indicated *"this means that the project is delayed, and you are unable to realise the value",* and **#D6** asserted "*what it means is that you have missed your timeliness, the project would delay, and you could have an implication on you cost as well".* These assertions by the participants indicate how well EVA is known and utilised in this company.

4.3.2 Cross-case analysis: EVA as a measure of project performance

In the telecommunication industry, it is evident that EVA is a common technique known and utilised across all the companies. This technique is used for measuring project performance and reporting based on budget, time and scope, as shown in Table 4.2 and Figure 4.1. In **Company A**, it measures project performance based on budget, time and scope. In **Company B**, it is used for measuring project performance and reporting. In **Company C**, it measures project performance based on budget, time and scope, as well as project specifications. In **Company D**, it measures the performance of a project based on the three dimensions of project management: is it within cost, is it within time and is it within scope?

In support of this, the project management practitioners (participants) across the companies, unanimously asserted that the situation where project work done consumed more budget than its initial estimated amount constitutes over budget (see Table 4.2 and Figure 4.1).

Similarly, they universally affirmed that a project is considered delayed when work done (earned value, EV) took a longer time than its initial planned duration (see Table 4.2). Therefore, it is suggestive that EVA and its applications are well understood and employed in the telecommunication industry, as illustrated in Table 4.2.

Figure 4.1 illustrates the elements derived from the discussions on EVA, that culminates in the development of the diagnostic model.

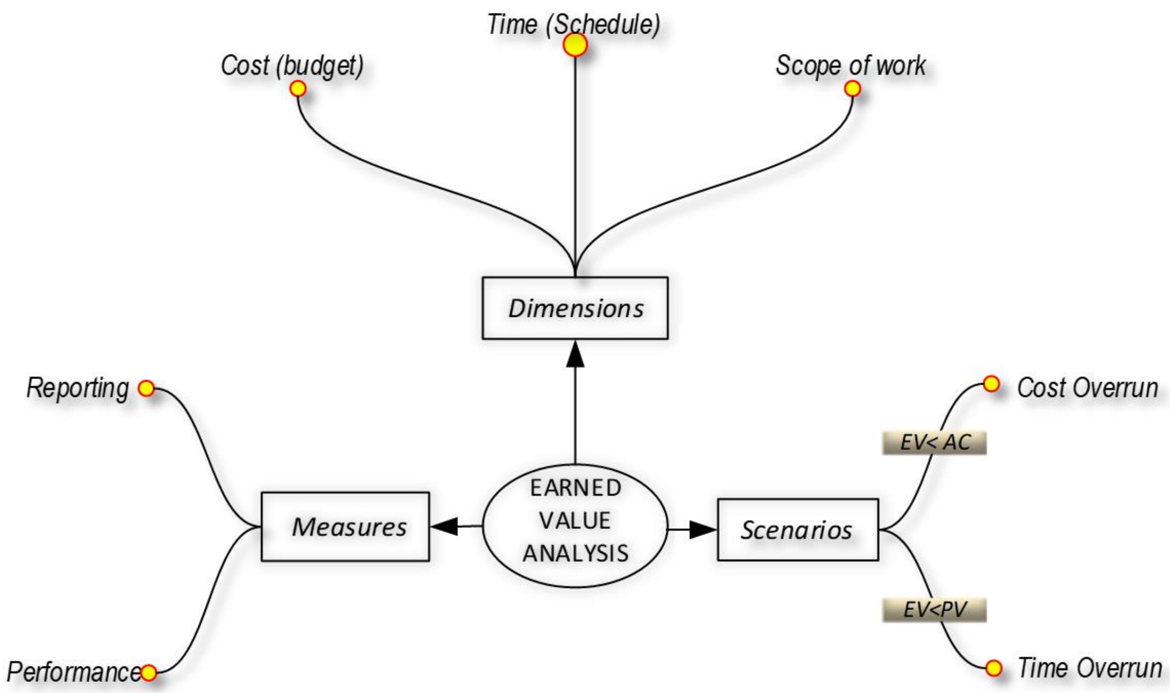


Figure 4.1: Elements derived from the narratives on EVA

Source: Researcher's construct from field data (2019)

4.4 VALUE LEAKS IN SITE PROJECT

Further to EVA as a measure of project performance, this section sought to ascertain the concept of value leaks, which is key to achieving Objective 1: analysing value leaks' causal factors, and Objective 4: developing value leaks diagnostic model that altogether accounts for achieving the ultimate aim of including value leaks into EVA as a measure of project performance.

In view of this, the value in delivering sites project and its measuring criteria, duration of delivering site projects and its associated costs, the extent to consider value leaks and its magnitude of occurrence, extent to which value leaks become problematic in delivery site project and how such occurrences are rectified are all addressed.

The abridged version of the analysis with regards to participants' key quotes is presented in Table 4.3. However, the comprehensive findings with respect to the main themes, key quotes, and key words from the participants are presented in Appendix 4.1. Also, the key elements derived from the narratives on cell site projects and value leaks are illustrated in Figure 4.2 and 4.3 respectively, which also serves as a summary of the discussion on value leaks in site projects.

Table 4.3: Summary of the quotes on Value Leaks during site projects

INTERVIEW GUIDE QUESTIONS	KEY QUOTES
Value in delivering Site project	**#D1**. Cell site rollout project provides better network access and increase speed. **#D2**. The value of delivering cell sites is ability to achieve the network KPIs stated in the business case. The outcome of delivering value through cell sites projects are to drive revenue, increase our mobile penetration, keep existing customers and get them to increase their spend on the network. Also, building more sites is a function of addressing quality issues, there could be a capacity concerns on the network where additional sites would fix the quality issues so enhancing user experience. **#D3**. Cell sites are what give coverage for telecommunication services. It aims at increasing coverage capacity and in some cases, meet regulatory requirements to avoid any kind of penalties or fines. Capacity is meant to enhance customer experience. We undertake cell sites project to introduce new technologies such as in the 4G LTE in recent. **#D4**. Cell site rollout is deployment of a telecom infrastructure in green field which aims at achieving better network capacity, extended coverage, speech quality and data access improvements or to resolve network congestions. **#D5**. Cell site projects are embarked on to introduce mobile coverage to green field. Also, embarked on to reduce congestion being experienced on some cell site due to traffic growth. i.e. Capacity expansions. **#D6**. Cell Sites rollout project is deployment of telephone sites at a location to provide coverage.
Criteria to measure the value of delivery site projects	**#D1**. The delivering of site project value must be within budget, meet the go-live date, meet the quality metrics such as availability, data speed, coverage and voice clarity etc. Also, ability to achieve the network KPIs stated in the business case. **#D2.** Delivering the service that the customers aspire, most importantly whether we are creating shareholder value as a result of delivering the sites. Is the site delivering on the promised revenues? So, if the site delivers the right customers experience, it would definitely meet the projected revenue we set out. **#D3.** First is the time (schedule), time is important because there has to be return on an investment, and meeting your schedule means that you can stay within your budget. Second, we look at cost, third, we look at scope or the specification and lastly, we look at quality of the implementation. The network KPIs are the measure of the experience of subscribers. This may be measured by telco themselves or use a third-party benchmark company. Ultimately revenue growth or generation from these sites are also a measure of the value of the cell site. For suppliers, value is measured via the project P & L and also through customer satisfaction which we do through periodic surveys; for suppliers some site rollout projects serve as strategic projects which can help to increase market share or capture high value areas. **#D4.** Largely, because you break your delivery work into work packages; each work package, you would have assigned some value in terms of what is costing you, how much time you are using on that, what that time translate into in terms of man-hours or workdays. So, all these ends up giving you an understanding of your earned value. So, the cost you have ascribed to a particular work package at the end of delivering that work.

INTERVIEW GUIDE QUESTIONS	KEY QUOTES
	#D5. The project is delivered within budget, the schedule is met as when I mean the schedule is the go-live date of getting that site on air is met, the quality metrics such as availability, data speed, and voice quality and clarity. Also, ability to achieve Sites rollout KPIs stated in the business case and time to market so revenues are realised per schedule. **#D6**. Usually beginning of the project, from the budgetary point of view there is a cost estimates, the agreed go-live timeliness and also there is certain KPI thresholds that are for structural integrity for equipment installations and then also for service delivery as well. All these metrics need to be met to be able to say that you have provided value for delivering the project.
Duration of site project	**#D1.** The number of sites and activities involved determine the duration. We have the minimum, which is 3 months, 6 months, 1 year and the maximum is two years. **#D2**. It depends on the site count and objectives of the project. If rollout 200 sites in a month would meet the Telco's revenue target, every measure would be put in place to achieve that. **#D3**. It depends on the scope, the time it takes to manufacture the equipment and ship ...colocation or greenfield. In Ghana over the years now, I would say that a typical duration for cell site rollout is around 4 to 6 months. Most operators, they are doing around 250-300 sites in terms of a rollout. **#D4**. Greenfield rollout, largely it ranges between 6 to 12 weeks which involves importation of hardware. Green fields generally, we talk about places that are not already served by the telecom service. **#D5**. A typical cell site can take 4 to 6 weeks and depends on quite a number of factors...to get regulatory approval, get equipment from the vendor, if you want to include all of these it would take 4 to 6 weeks to 3 months. When all regulatory approvals are given, deployment takes 2 weeks which includes post testing and acceptance of the sites. The project in totality from initiation through to closure, it can take up to 3 months but just implementation or deployment can take 2 weeks. A greenfield is areas where there is no coverage. **#D6**. Duration is determined by the number of sites involved. From practical experience, it ranges from 6 months to 2 years based on the number of greenfield and brownfields are involved. A greenfield is basically a completely new location deploying the tower and then deploying the site equipment on it. A brown field is an upgrade on an existing site, or an additional technology introduce to an existing site.
Costs involved to rollout a site project	**#D1**. It is capital intensive which ranges from $100K and it depends on the magnitude of the project. You cannot classify a single cell site as a project. For site rollout, we can have a minimum of 30 sites and these 30 sites ranges from $100K to $250K. **#D2**. One of the major cost components in site rollout is the cost of equipment. …the equipment is imported, which means there is a lot of reliance on foreign currency to import it. …external factor as the forex exchange also plays a huge impact on the cost of the project. …the external factors contribute to cost inflation of the rollout. **#D3**. Telecommunication is not cheap; it is capital intensive and very expensive. For a single technology greenfield site, we are looking at around $80K and for colocation we are looking at around $40K.

INTERVIEW GUIDE QUESTIONS	KEY QUOTES
	#D4. Cost is usually enormous, and it is not fixed to box because it depends on nature of the field you are going to work in and the constraints you have to outrun. From my experience, a site could range between $10K to $20K. **#D5.** The cost is capital intensive as services alone are in excess of USD 7.5K for Radio access, Network and transmission installation and equipment supply in the region of USD 10K per cell site. In the region of USD 25K for active components. *base transceiver station, the antennas* and a passive component where based on the structure, cell sites carriers do not own the physical infrastructure like the LAN, towers, generators, those are termed as the passive elements. **#D6**. Site deployments are very capital intensive and the costs are quite high.
Extent to consider value leaks during site project deployment	**#D2.** The value leak is the opportunity cost of not finish on time. We need the site on the particular date to deliver a special event which is supposed to bring in customers on a particular site and we failed to turn on the site on that particular date, obviously then the value is lost. **#D3**. I can give an example of a competitor's case working in one of the telcos, who accepted to do one of the projects and this project actually run into a lot of cost overruns and the initial projections were not met. So subsequently, the inability to deliver according to the customers' expectations left to several years of dissatisfaction by the telco. Eventually, that supplier was replaced. For suppliers this kind of loss of value is very important to us because the operator will only continue to invest if the value of the project is realised if there is no value then future business will definitely be at risk. **#D4**. Value comes in multiple forms and falls in all the constraints the project sits in. There is value that is lost if cost is impacted, there is value lost when your schedule extends, there is value lost when you deliver low quality or your quality metrics are impacted and you have to do rework, there is value lost when your stakeholders are dissatisfied, and you have to make extra investment of time, cost or additional skills or expertise to manage their interest and get them to faith in the business you are out to do. **#D5**. The occurrence of over budget, schedule delay, rework due to poor quality can prolong the go live date resulting in delays in revenue realisation and delays in customer acquisition which means value may be considered lost. **#D6**. The value would definitely be missed if the cost budgeted; the money finishes before the project is delivered, if the time is exceeded, if an installation is done wrongly, all these would reduce the value of the project.
Estimate the amount of value that leaks during site project	**D1**. You can have 1 to 2 weeks delays which is adjustable but when a delay comes for 1 month or more, then it becomes a big issue. Because, when it is 1 or 2 weeks, you can mitigate it by putting much effort to overcome that delays. But when it goes beyond a month, then it turns red which is no go area. Because going a month means, you are going to increase your cost and resources. **#D2**. Because of the experience we have built over the years and the fact that we try to mitigate these as much as possible, for every 10 sites, there could be just one or two, which can go up to 3 to 4 weeks' time overrun if the right permitting gets delayed.

INTERVIEW GUIDE QUESTIONS	KEY QUOTES
	#D3. We can have 1 to 2 months delays and this varies from an operator to operator. Different operators have different internal processes and different organisational cultures which affect the time overrun. Value may be impacted but where the additional cost is borne by the telco or the supplier it may not be considered as lost. The potential return on investment may be impacted. **#D4.** Value leaks on general front happens sometimes. If you look at it on the whole, i.e. in terms of cost, quality, schedule, 3 to 5 weeks' time overrun can happen. There was one project that delayed for about 3 weeks. You can also exceed your budget between \$100K and sometimes up to \$120K. **#D5**. We can have time overrun of 3 weeks and poor quality resulting in rework which increases the project cost.
Extent to which value leaks become problematic in delivery site project **(i) Frequency of value leaks occurrence in site project**	**#D1.** Value leaks affects the project budget, resulting from cost overrun and rework due to poor quality. It can also affect the product launch date for example if we are rolling out 4G into the market to gain competitive advantage, value leaks can cause the launch date to delay. **#D2**. The overall effect is the fact that you lose out on the opportunity of the revenues that come on the site. If the daily revenue of a site is Ghs10K, it is Ghs10K loss for each day. **#D3**. You may face a risk of a swap, where the telco might replace you with your competitor. From the operators' perspective, the business case from the whole project will be questionable when there are delays because the projections are not met. And from the Vendors' perspective, delays will increase in cost because of their daily rate for some of the resources that are engaged to do the work. I would say sometimes. **#D4.** There could be fines from the Regulator which erodes your image, your brand is impacted, customers are dissatisfied, so value in multiple forms are impacted. Value leaks on general front happens sometimes. **#D5**. With cost overrun, the project value of expanding network coverage and improving customer experience, you would not able to meet it because you are not able to fund it. **#D6**. If there is any quality that is degraded in the delivery of the project, what it means is that the acceptance of the project would delay which extends the project timeliness and then you need to retain resources at extra cost to be able to fix whatever quality issues that come up. it happens rarely.
How such value leaks occurrences are rectified	**#D1** …bring in experienced people which would cost you extra budget to complete the work. If you do not do that and the customer lose hope in you, they may charge you for delaying the project. Also, you ensure constant monitoring and controlling of the KPIs in measuring the delivering of Cell Sites rollout project. **#D2**. This is the business of airtime so whatever you lose in a particular time is not recovered. Learn from it and make sure that in future occurrence you try to take the learns learnt and prevent reoccurrence of such loss. Also, we try as much as possible to fast-track and address the causal effect of the delays. **#D3.** Once value leaks are identified, mitigation steps are out in place almost immediately. We have routine checks and surveys are conducted with operators as gauge or barometer to help us ensure the value of customer satisfaction is maintained. When it

INTERVIEW GUIDE QUESTIONS	KEY QUOTES
	comes to value losses in terms of staying out of the budget, there is a system tool that provide control and monitors the project budget to ensure that these things do not happen. If they happen, they are mitigated through variations and going for further application for budget. Project delays we need to pump in more resources to catch up the time. For which case, the cost must be accepted by the company as a loss. **#D4.** Value leaks in multiple areas, e.g. quality means you need to do extra performance monitoring. So, the earlier you are able to monitor the KPIs of your sites and identify the issues, the earlier you are able to rectify situation and prevent further degradations. In terms of stakeholders: the earlier you identify the sentiments and concerns and address it, the earlier you are able to prevent the cancer from spreading. **#D5**. We ensure monitoring and control tasks contained in the project management plan are executed to the letter and there is effective communication as well. Also, we applied crashing and fast tracking which all the time have cost implication and revenue realisation would not come in as per scheduled. **#D6.** Find other activity that you would be able to use to beat up the time. There are quick wins-activity that based on your project plan, you might have to either secure resources or get resources to work overtime to able to meet that timeliness. Benchmark your projected cost to what is realised which allows you to be able to get any red flags as soon as value leaks come so that you would use the contingency budget to manage it.

Source: Researcher’s construct from field data (2019)

4.4.1 Case analysis Company A – D

Company A

In this case, the evidence, as shown in Table 4.3, suggests that the value in delivering a site project is mainly providing and increasing coverage capacity, either to meet regulatory requirements or to enhance customer experience with new technology, as alluded to by the Programme Director:

> *"Cell sites are what give coverage for telecommunication services. It aims at increasing coverage capacity and in some cases, meet regulatory requirements to avoid any kind of penalties or fines. Capacity is meant to enhance customer experience. We undertake cell sites project to introduce new technologies such as in the 4G LTE in recent."*

The findings also indicate that criteria for assessing the value of delivery site projects can be viewed from two perspectives; *during the deployment* (on-time delivery, within cost, scope and quality) and *post-deployment* (network KPIs, customer satisfaction, revenue growth, project profit and loss, increase market share, capture high areas), as he further indicated:

> *"First is the time (schedule), time is important because there has to be return on an investment, and meeting your schedule means that you can stay within your budget. Second, we look at cost, third, we look at scope or the specification and lastly, we look at quality of the implementation. The network KPIs are the measure of the experience of subscribers. This may be measured by telco themselves or use a third-party benchmark company. Ultimately revenue growth or generation from these sites are also a measure of the value of the cell site. For suppliers, value is measured via the project P & L and also through customer satisfaction which we do through periodic surveys; for suppliers some site rollout projects serve as strategic projects which can help to increase market share or capture high value areas."*

Again, the evidence shows that there are a number of factors that contribute to determining the total duration of a site deployment. These factors include the scope, colocation or brownfield (upgrade on an existing site), greenfield (an area where there is no cell coverage), and equipment manufacturing. However, a typical site deployment contains 250 to 300 number of sites which usually takes four to six months to complete. The cost associated with this deployment is considered to be extremely expensive, as a single technology greenfield site with civil works costs approximately $80 000 and colocation costs approximately $40 000, as he affirmed:

> *"It depends on the scope, ...time it takes to manufacture the equipment and ship ...colocation or greenfield. In Ghana over the years now, I would say that a typical duration for cell site rollout is around 4 to 6 months. Most operators, they are doing around 250-*

300 sites in terms of a rollout. Telecom is not cheap; it is capital intensive and very expensive. For a single technology greenfield site, we are looking at around $80K and for colocation we are looking at around $40K."

In addition, when the researcher enquired about the extent to which value is considered leaked and the amount of value that leaks during site project, the findings suggest that cost overruns resulting in stakeholders' dissatisfaction and time overruns, among others, are the evidence of value leaks, and as a supplier, such value loss is a serious matter in their business continuity and sustainability. Time overrun usually lasts between one and two months, but it varies from one operator to the other, as the Programme Director opined:

> *"I can give an example of a competitor's case working in one of the telcos, who accepted to do one of the projects and this project actually run into a lot of cost overruns and the initial projections were not met. So subsequently, the inability to deliver according to the customers' expectations left to several years of dissatisfaction by the telco. Eventually, that supplier was replaced. For suppliers this kind of loss of value is very important to us because the operator will only continue to invest if the value of the project is realised, if there is no value then future business will definitely be at risk. We can have 1 to 2 months delays and this varies from an operator to operator. Different operators have different internal processes and different organisational cultures which affect the time overrun."*

Moreover, when asked about the extent to which value leaks become problematic in a delivery site project and how such occurrences of value leaks are rectified, they answered that as a supplier, they are much more concerned about the loss of future business resulting from value leaks, and stated: *"for suppliers this kind of loss of value is very important to us because the operator will only continue to invest if the value of the project is realised, but if there is no value then future business will definitely be at risk."* In addition, the Programme Director held that the resources engaged to work on the project's daily rate due to delays, increased project cost as stated:

> *"From the operators' perspective, the business case from the whole project will be questionable when there are delays because the projections are not met. And from the Vendors' perspective, delays will increase in cost because of their daily rate for some of the resources that are engaged to do the work."*

In rectifying the occurrence of value leaks in this case, they carry out routine checks with the network operators as a gauge to maintain value during site delivery, and further consider the extra budget spend to complete the project in the midst of value leaks as a loss to the company, as opined by the Programme Director:

"We have routine checks and surveys are conducted with operators as gauge or barometer to help us ensure the value of customer satisfaction is maintained. When it comes to value losses in terms of staying out of the budget, there is a system tool that provide control and monitors the project budget to ensure that these things do not happen. If they happen, they are mitigated through variations and going for further application for budget. For which case, the cost must be accepted by the company as a loss."

Company B

In this case, the value in delivering the site project is about the deployment of telecomtelecommunication infrastructure in a greenfield. This aims to achieve better network capacity, extended coverage, speech quality and improve data access, or to resolve network congestion due to traffic growth, as indicated in Table 4.3 and Appendix 4.1. Also, the findings showed that the delivery of the project on time, within cost, specification and quality are the key criteria used to measure the success of the deployment, as affirmed by both **#D4** and **#D5**:

"Largely, because you break your delivery work into work packages; each work package, you would have assigned some value in terms of what is costing you, how much time you are using on that, what that time translate into in terms of man-hours or workdays. So, all these ends up giving you an understanding of your earned value. So, the cost you have ascribed to a particular work package at the end of delivering that work." (Project Manager)

"The project is delivered within budget, the schedule is met as when I mean the schedule is the go-live date of getting that site on air is met, the quality metrics such as availability, data speed, and voice quality and clarity. Also, ability to achieve Sites rollout KPIs stated in the business case and time to market so revenues are realised per schedule." (Network Planning Manager)

In addition, an enquiry into the duration and cost involved to deliver a site project elicited the answer that a deployment at a greenfield takes up to three months to complete, but factors such as hardware importation can impact it, as **#D4** stated:

"Greenfield rollout, largely it ranges between 6 to 12 weeks which involves importation of hardware. Green fields generally, we talk about places that are not already served by the telecommunication service."

A minimum cost of deploying a site can take up to $25K, which includes both service and active component costs, however, since physical infrastructure (such as towers and generators) is not owned by telecommunication companies, the company pays GH₵13K to 14K monthly as rent fees to the towercos (tower companies), as **#D5** opined:

> *"The cost is capital intensive as services alone is in excess of USD 7.5K for Radio access, Network and transmission installation and equipment supply in the region of USD 10K per cell site. In the region of USD 25K for active components. base transceiver station, the antennas and a passive component where based on the structure, cell sites carriers do not own the physical infrastructure like the LAN, towers, generators, those are termed as the passive elements."* (Network Planning Manager)

Furthermore, the evidence on the extent to which value leaks should be considered during site project deployment suggests that value comes in multiple forms, and may be lost when cost is impacted, project schedule is extended, low quality work is delivered that necessities rework, stakeholders are dissatisfied and extra investment of time, cost or additional expertise is required to complete the project, as opined by **#D4**:

> *"Value comes in multiple forms and falls in all the constraints the project sits in. There is value that is lost if cost is impacted, there is value lost when your schedule extends, there is value lost when you deliver low quality or your quality metrics are impacted and you have to do rework, there is value lost when your stakeholders are dissatisfied, and you have to make extra investment of time, cost or additional skills or expertise to manage their interest and get them to faith in the business you are out to do."* (Project Manager)

Similarly, in the quest to estimate the amount that value leaks constitute during deployment, the evidence indicates that site projects go over budget as high as $120K resulting from delays, reworks etc., as further indicated by **#D4**:*"you can also exceed your budget between $100K and sometimes up to $120K in terms of cost, quality, schedule."* With time overrun, **#D5** also added that *"We can have time overrun of 3 weeks and poor quality resulting in rework which increases the project cost."* In view of the extent to which value leaks become problematic in delivery site project, the findings show that this company cares so much about inability to achieve the value of network expansion, revenue loss, and regulatory fines leading to bad brand image as affirmed by both **#D4** and **#D5**:

> *"There could be fines from the Regulator which erodes your image, your brand is impacted, customers are dissatisfied, so value in multiple forms are impacted."* (Project Manager)

> *"With cost overrun, the project value of expanding network coverage and improving customer experience, you would not able to meet it because you are not able to fund it."* (Network Planning Manager)

Lastly, the findings suggest that value leaks can be rectified through monitoring and controlling tasks contained in the project management plan and KPIs through effective communication. With regards to stakeholders, the earlier their sentiments and concerns are addressed, the better to prevent the cancer from spreading (see Table 4.3 and Appendix 4.1).

Company C

In this case, the evidence indicates that the value of site project is to provide better network access and increase speed as **#D1**, the Project Manager opined: "*Cell site rollout project provides better network access and increase speed."* Also, the findings suggest that time, cost, specification, business case KPIs, and quality are the criteria to measure the value of delivery site in this company as he stated: "*The delivering of site project value must be within budget, meet the go-live date, meet the quality metrics such as availability, data speed, coverage and voice clarity etc. Also, ability to achieve the network KPIs stated in the business case."* Furthermore, an enquiry into the duration and costs involved in delivery value of site projects proposes that it takes a minimum of three months and maximum of two years to complete cell site projects and minimum of 30 sites costs, ranges from $100K to $250K (see Table 4.3 and Appendix 4.1).

In addition, the evidence on the extent and amount of value leaks during deployment suggests that having 1 to 2 weeks' delay seems tolerable but exceeding a month becomes a big problem, as Project Manager further asserted:

> *"You can have 1 to 2 weeks delays which is adjustable but when a delay comes for 1 month or more, then it becomes a big issue. Because, when it is 1 or 2 weeks, you can mitigate it by putting much effort to overcome that delays. But when it goes beyond a month, then it turns red which is no go area. Because going a month means, you are going to increase your cost and resources."*

Further, the findings on the extent to which value leaks become problematic in the delivery of a site project are that it affects the project budget, cost and poor quality due to rework, as well as product launch date, which has a negative effect on gaining a competitive advantage (see Table 4.3 and Appendix 4.1). To rectify value leaks' occurrence, this company sacrifices extra budget to bring in experienced people to complete the project to avoid penalties from the network operators, as stated by the Project Manager:

> *"Value leaks affects the project budget, resulting from cost overrun and rework due to poor quality. It can also affect the product launch date for example if we are rolling out 4G into the market to gain competitive advantage, value leaks can cause the launch date to delay.*

> *Bring in experienced people which would cost you extra budget to complete the work. If you do not do that and the customer lose hope in you, they may charge you for delaying the project."*

Company D

In this case, the evidence suggests that deploying site project seeks to provide network coverage at locations where there is none as stated by **#D6**, Head, Radio Frequency Planning & Optimisation*: "Cell Sites rollout project is deployment of telephone sites at a location to provide coverage."* The value outcome of site project is to drive revenue, increase mobile penetration, keep existing customers and get them to increase their spend on the network, enhance user experience etc., as affirmed by **#D2,** Network Planning Director (see Table 4.3 and Appendix 4.1). Besides, the finding on criteria to measure the value of delivery site projects includes customer aspirations and shareholder value as **#D6** indicated ***"****delivering the service that the customers aspire, most importantly whether we are creating shareholder value as a result of delivering the sites*." In addition, meeting agreed go-live date, within budget, KPIs and all the quality metrics are all measures to assess the value of site project during deployment as **#D6** opined:

> *"Usually beginning of the project, from the budgetary point of view there is a cost estimates, the agreed go-live timeliness and also there is certain KPI thresholds that are for structural integrity for equipment installations and then also for service delivery as well. All these metrics need to be met to be able to say that you have provided value for delivering the project."* (Head, Radio Frequency Planning & Optimisation).

The evidence suggests that sites count, and project objectives usually determine the duration of the site rollout. In view of this, it ranges from 6 months to 2 years based on the number of greenfields and brownfields involved. The distinction obtained between greenfield and brownfields is that whereas greenfield is a completely new location of deploying the tower and the site equipment, a brownfield is an upgrade or an additional technology on existing sites as stated by **#D6** (see Table 4.3 and Appendix 4.1). The factors that influence cost of deploying sites includes equipment cost, reliance of foreign currency to import the equipment, exchange rate as well as inflation as affirmed by **#D2** (see Table 4.3 and Appendix 4.1). Also, an enquiry into the extent to consider value leaks during site project deployment suggests that the value that is not realised during cell site project deployment is considered lost or leaks and it becomes evident when budget runs out, timeliness are missed, and poor quality occurred which necessitates rework, as opined by **#D6**:

"The value would definitely be missed if the cost budgeted; the money finishes before the project is delivered, if the time is exceeded, if an installation is done wrongly, all these would reduce the value of the project."

The findings again suggest that in the midst of value leaks, this company is concerned about the delay in customer acquisition onto their networks as cited by **#D2**:

"The value leak is the opportunity cost of not finish on time. We need the site on the particular date to deliver a special event which is supposed to bring in customers on a particular site and we failed to turn on the site on that particular date, obviously then the value is lost." (Network Planning Director)

In line with estimating the amount of value that leaks and extent to which it becomes problematic in delivery site project, the evidence suggests that in every 10 sites at most 2 sites encounters time overrun, lasting from 3 to 4 weeks although effort is made to minimise such occurrence but its repercussion is that the expected revenue is lost as opined by **#D2:**

"Because of the experience we have built over the years and the fact that we try to mitigate these as much as possible, for every 10 sites, there could be just one or two, which can go up to 3 to 4 weeks' time overrun if the right permitting gets delayed. The overall effect is the fact that you lose out on the opportunity of the revenues that come on the site. If the daily revenue of a site is Ghs10K, it is Ghs10K loss for each day." (Network Planning Director–Case study D)

In rectifying value leaks occurrences, the findings indicate that constant monitoring and checking of quality metrics is used to rectify quality issues as stated by #D6 (see Table 4.3 and Appendix 4.1). In addition, the evidence shows that value lost cannot be recovered so lessons must be learnt for future occurrence but with the immediate response, fast-tracking is used to address the causal effect of the delays as alluded to by **#D2:**

"This is the business of airtime so whatever you lose in a particular time is not recovered. Learn from it and make sure that in future occurrence you try to take the lessons learnt and prevent reoccurrence of such loss. Also, we try as much as possible to fast-track and address the causal effect of the delays."

4.4.2 Cross-case analysis: Value leaks in site projects

In the telecommunication industry, it is evident that the value in delivery site project is to provide network access to grow business, ensure speed to market, drive and increase revenue, enhance user experience etc., as illustrated in Figure 4.2, Table 4.3 and Appendix 4.1. In view of this, **Company A,** emphasised that site project provides coverage to enhance customer experience and meet regulatory requirement. In **Company B,** it introduces mobile coverage to greenfields to expand capacity and resolve network congestion. In **Company C,** it provides better network access and increase speed. In **Company D,** site projects drive revenue, increase mobile penetration, keep existing customers and get them to increase their spend on the network etc.

In addition, the perspectives across the companies suggest that the value through site projects can be measured during *deployment* and *post deployment*. The common criteria running through their assertions as measuring of value (similar to success criteria) during sites deployment are meeting go live date (sites on air), delivery within budget, scope and meeting all the quality metrics (such as availability, data speed, voice quality and clarity). The criteria suggested to measure post deployment value of delivering site projects are network PKIs, customer satisfaction, revenue growth, project profit and loss, increase market share, capture high areas (see Figure 4.2).

On the contrary, the total cost and duration involved in deploying site projects varies from one company to other. Whereas, in **Company A,** deployment in greenfield cost $80K with a duration of 4 to 6 months and brownfield or colocation cost $40K, in **Company B**, a site could cost $10K to $20K with a duration of 6 to 12 weeks, in **Company C,** 30 sites cost about $100K to $250K with a duration of 3months, 6months to 2years. Nevertheless, the companies commonly asserted that the duration of site project depends on number of factors; whether the deployment is in a greenfield or brownfield (collocation), and the number of sites involved as indicated in Table 5.3 and exhibited in Figure 4.2 leading into the development of the models.

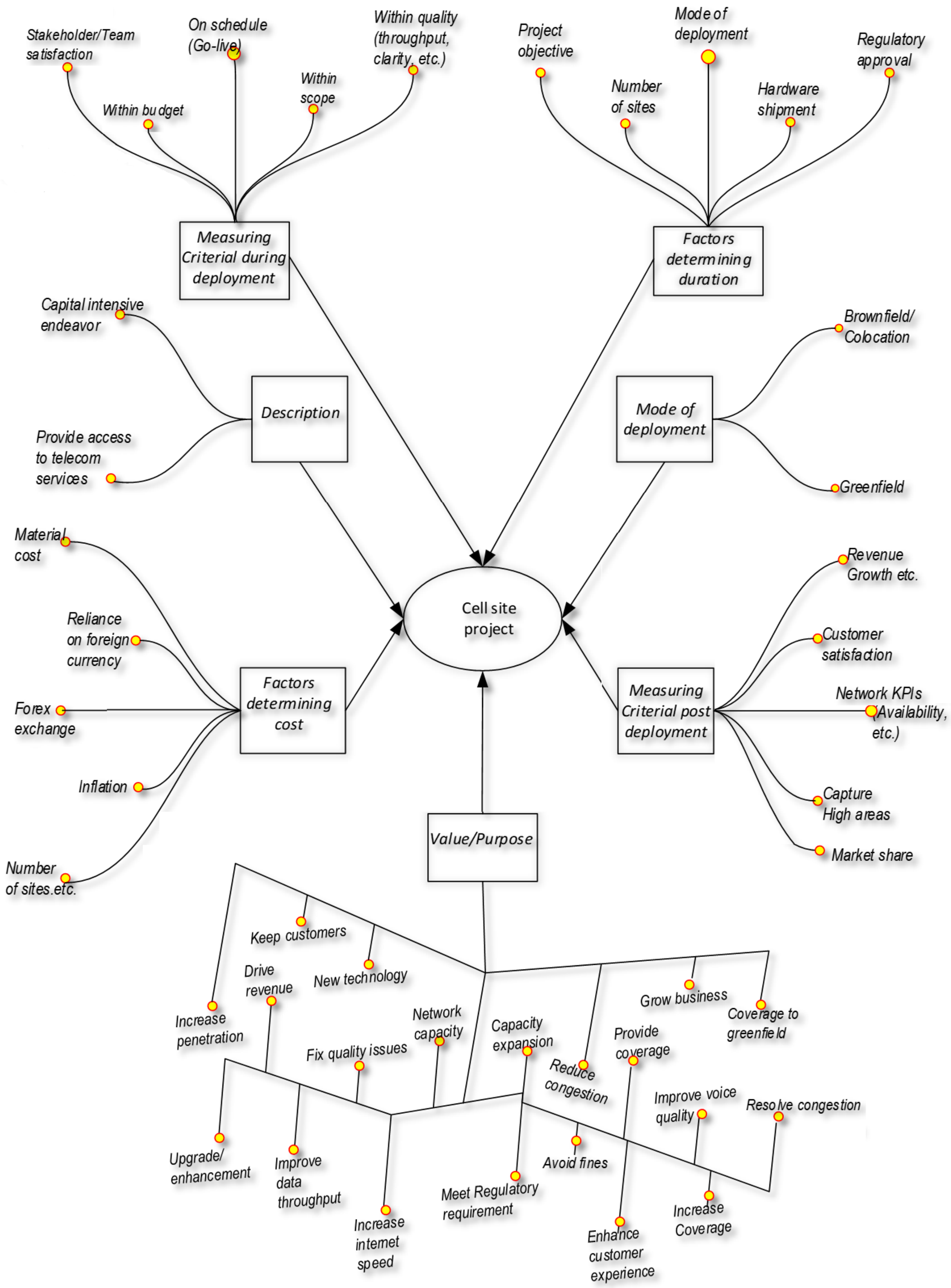


Figure 4.2: Elements derived from the narratives on cell site projects

Source: Researcher’s construct from field data (2019)

In line with the extent to which value is considered leaked during a site project, although it is expressed differently across the companies, it generally meant that value leaks can be considered when going over budget (cost overrun), schedule extends (time overrun), stakeholder (team) dissatisfaction, scope creep (out of scope) and quality metrics are impacted (rework), as exemplified in Figure 4.3.

In view of this, **Company A** asserted that this happens when a project runs into a lot of cost overruns and the initial projections are not met. In **Company B,** value is lost when cost is impacted, schedule extends, quality metrics are impacted and requires rework, stakeholders are dissatisfied and extra investment of time, cost or additional skills or expertise is required to manage their interest. In **Company D**, value is missed when budget amount finishes before the project is delivered, time is exceeded, and installation is done wrongly.

In the quest to estimate the amount of value leaks during deployment, the evidence offers different perspectives across the companies. **Company A** emphasised 1 to 2 months' delays, which varies from an operator to another. In **Company B,** value leaks occur sometimes. A project can delay 3 to 5 weeks and go over budget as high as $120K resulting from delays and reworks. In **Company C,** a delay of 1 to 2 weeks' seems tolerable but exceeding a month becomes a big issue. **Company D** indicated that for every 10 sites, one or two can go up to 3 to 4 weeks' delay. Although all the companies expressed it differently, they commonly emphasised that a site project delivered with quality issues brings about rework which increases project cost (see Table 4.3 and Appendix 4.1).

Moreover, the evidence on the impacts of value leak and extent to which it becomes problematic in the delivery of sites suggests that, while the vendors are more concerned about the risk of being replaced by the mobile operators resulting in loss of future business, the operators also care just as much about the revenue loss, regulatory fines, and customer dissatisfaction leading to bad brand image and so forth, as outlined in Table 4.3.

In this regard, **Company A** asserted that the supplier faces a risk of being replaced by the network operator. In **Company B,** fines from the Regulator erodes corporate image resulting in customers dissatisfaction. In **Company C,** value leaks affect the product launch date impacting the ability to gain a competitive advantage. **Company**

D emphasised that the overall effect is losing out on the revenue opportunity because if the daily revenue of a site is Ghs10K, it is Ghs10K loss for each day.

Nonetheless, all the companies commonly emphasised that value leaks have a financial impact on the site project. Specifically, network operators assert that revenue projections in the business cannot be realised amidst value leaks, and the vendors maintain that the resources required to work on the project due to delays would increase the project cost. Finally, the evidence indicates that issues of quality are paramount in the delivery of telecommunication projects. The repercussion of poor quality cannot be overemphasised, as apart from cost and schedule implications, it can even lead to death (see Table 4.3, Figure 4.3 and Appendix 4.1).

In order to mitigate the occurrence of value leaks during site deployment, a list of rectification measures is provided across the companies. In **Company A,** routine checks are carried out with the network operators as a gauge to maintain value during site delivery. They have a system tool in place to provide control and monitor the project budget. Also, they consider the extra budget spent to complete the project in the midst of value leaks as a loss to the company.

Company B emphasised that the monitoring and controlling tasks contained in the project management plan should be executed to the letter and there should be effective communication as well.

In **Company C,** extra budget is sacrificed to bring in experienced people to complete the project in order to avoid penalties from the network operators.

In **Company D,** value lost at a particular point in time cannot be recovered, so lessons are taken to avoid the reoccurrence in future projects, and also, to complete the project, a fast-track strategy is resorted to in executing the remaining work to the letter. In addition, timely monitoring and controlling of the key performance metrics, KPIs, is vital in minimising the occurrence of value leaks during site projects, as demonstrated in Figure 4.3 and Table 4.3

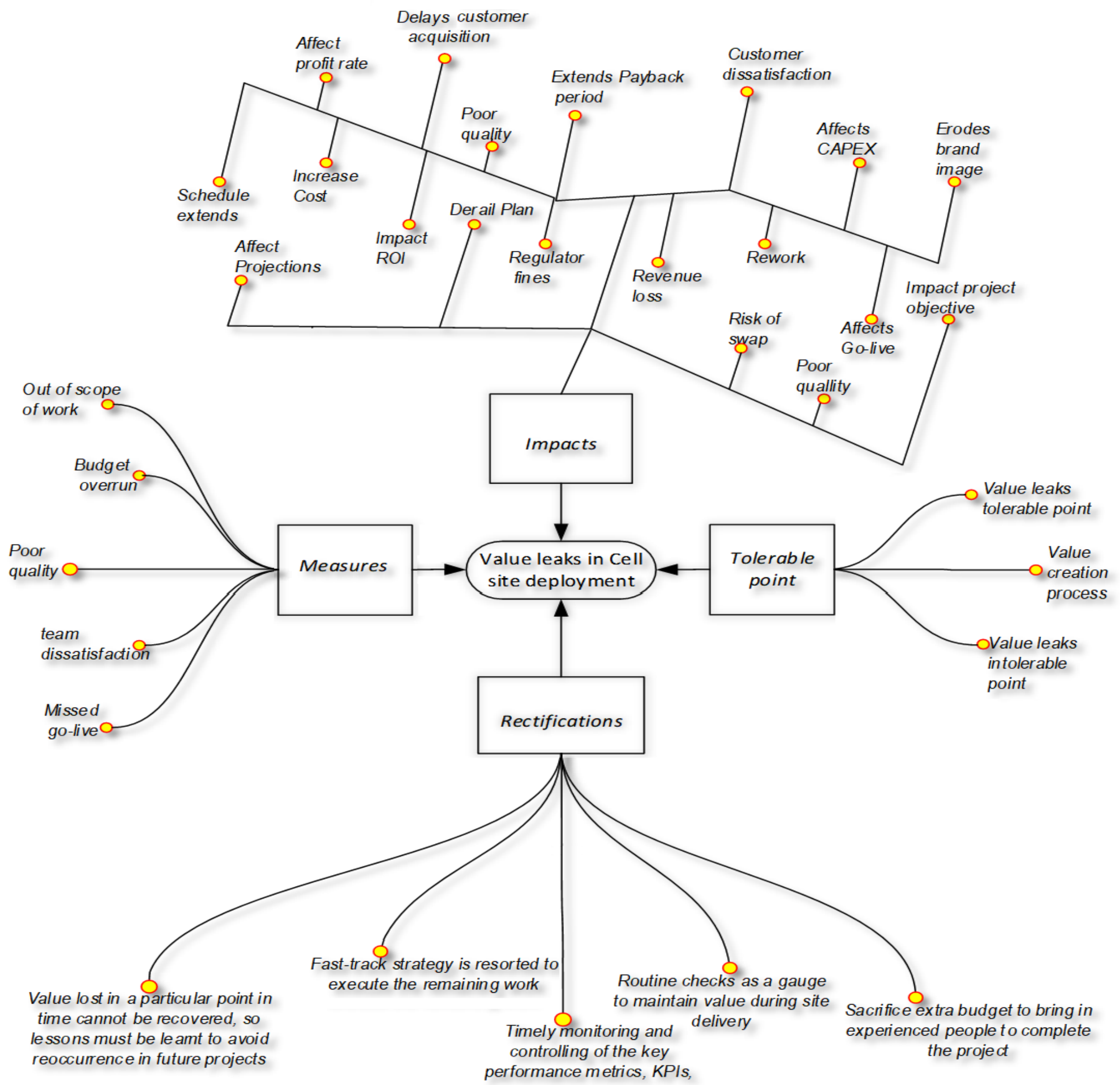


Figure 4.3: Elements derived from the narratives on value leaks during site project deployment

Source: Researcher's construct from field data (2019)

4.5 MEASURES AND FACTORS OF VALUE LEAKS

In addition to establishing the application of EVA as a measure of project performance in the telecommunication industry and the concept of value leaks within the context of site projects deployment, this section sought to address Objective 1, by determining the factors that cause value leaks during site project deployment. This analysis is presented based on the measures of value leaks: time overrun causal factors, cost overrun causal factors, poor quality, out of scope causal factors and team dissatisfaction causal factors. The condensed findings are presented in Table 4.4, and in Figures 4.5, 4.7, 4.9 and 4.11 (see Appendix 4.2 for full details).

Table 4.4: **Summary of the quotes on factors of Value Leaks**

AREAS	INTERVIEW GUIDE QUESTIONS	KEY QUOTES
TIME OVERRUN (TO)	Definition of project time overrun	**#D1**. When a project is scheduled to be done within 3 months and it actually takes 4 to 5 months to complete, that is time overrun **#D2**. Every project has a set time that has to be completed. It has a start time and a finish time, once the finish time is missed then there is an occurrence of time overruns **#D3.** Time overrun is the additional time spent to complete the project after the originally planned date could not be achieved **#D4**. Time overrun is generally indicating your deviation or exceeding the time you have initially planned to execute your site rollout **#D5**. It is essentially the additional time we have to spend to complete a project after the planned delivery date is not achieved
	Frequency and approximation of time overrun occurrence	**#D1**. Sometimes, …when it is 1 or 2 weeks, you can mitigate it by putting much effort to overcome that delays. But when it goes beyond a month, then it turns red which is no go area. Because going a month means, you are going to increase your cost and resources **#D2** Sometimes, it can go up to 3 to 4 weeks if the right permitting gets delayed **#D3.** 1 to 2 months delays and this varies from an operator to operator. Different operators have different internal processes and different organisational cultures which affect the time overrun **#D4.** It happens often and approximately; 3 to 5 weeks overruns can happen. There was one project that delayed for about 3 weeks **#D5**. Sometimes and approximately it can give you an overrun of 3 weeks **#D6.** Sometimes
	Description of project delay (time overrun) impact on delivery of site projects	**#D1.** Time overrun has a negative impact on a Cell Sites rollout project because time is one of the three triple constraints and any deviation from the schedule influences the cost and scope of the project to change. When a project delays like that all the other factors come in. Your cost will increase, for example, if you have to spend $20K for a project, delay for a month or 2 can increase your cost to $30K. So, in that, it makes you somehow inefficient in project delivery. **#D2.** You start deriving revenues from the site the moment the site goes on air. Let's say the site is supposed to give you a monthly revenue of Ghs10K so for every 4weeks delay, it is GHs10K lost

AREAS	INTERVIEW GUIDE QUESTIONS	KEY QUOTES
		#D3. Time overrun obviously has negative impact on cell site rollout project and time is a constraint in any project delivery. This will impact the cost, and sometime the scope of the project will change. Time overrun really has huge impact on the cost and the suppliers as well. **#D4**. There are cases where this leads to team dissatisfaction, because you at times hold people to greenfield that are in very remote area. The team is on-site and very little things are delaying the work and they cannot get to their families **#D5.** So before one decides to deploy at a location, there would have been a business case to determine what sort of revenues you are going to get and based on that there is time plan on how to meet those targets. So, if I am not able to go live on a certain date, it means the expected revenues do not come and this is the effect of your schedule delay **#D6.** It means what you planned getting, within a period of time would not be realised which would have financial impact on the company
	Outline the project delay causal factors	**#D1**. It depends on the RFI (i.e. Ready for integration or Ready for implementation) of the site, in terms of customer making the things needed to rollout the site and there is delay from that side, it will cause delay in rollout as well. Ready for integration: this is when all installations have been done, and we need to integrate or commission the site. So, we can easily take the equipment and install on the tower. Ready for installation/implementation: civil works and other physical things like building the tower, providing power and generator are done. Again, lack of top management support, poor contract management, poor monitoring and control, poor scoping, internal approval processes. **#D2.** There are different things that cause delays, it could be delay in seeking budget approval to even start the project, it could be delay from the vendor side in importing the hardware into the country, it could delay in clearing the hardware from the port, it could be delays in preparing the sites itself for the rollout. So, the tower companies must prepare the sites in terms of providing you the power to the sites and usually these tower companies encounter some challenges which limit them from meeting the timeliness that we set for them. So, there are different factors that contribute to delays in a project and also, during implementation itself, the team needs time to wrap up so usually it takes time for the team to get to speed and to start deploying at the right pace. What also causes a major delay is delay in a shipment if the vendor does not provide the right shipping information, it becomes difficult in clearing the items from the port and this could go up to 3 to 4 weeks as well. Also, poor communication skills, lack of top management support, non-availability of project contractors, delay in seeking budget approval, delay from the vendor side in importing the hardware into the country. **#D3.** Time overrun is actually quite a problem, topmost among these are for example of issuing of POs, getting the site ready for installations, sometime availability of the resources in the country to also meet the rollout demand. In a case of PO for example, this delays the start of the entire project itself and once the start time is

AREAS	INTERVIEW GUIDE QUESTIONS	KEY QUOTES
		delayed is also impact on time window within which to finish the project and get some returns within the financial year. In terms of the site being ready for installations, this also has a big impact on the cell site rollout because the site is not ready for installations, obviously, the equipment will sit in the warehouse until the site is ready. We have delays because there are many parties involved in getting the site ready, i.e. telco has to liaise with the tower company, which would then I liaise with its subcontractors and related city authorities to then get site ready and constructed in terms of the equipment arrival. When it comes to qualified installations teams also; as a small country, there resources are not infinite. So, there is a finite number of qualified installation resources. Obviously, the more team you have, the more progress, you can make in a day. too many parties involved in the project, inaccurate time & cost estimate, inadequate resources, poor scoping, lack of experienced contractors, late delivery of materials, issues of project funding, internal organisational processes, site permits by the communities, organisational cultures. **#D4**. Poor planning; inaccurate time and cost estimate; poor scoping, contract management not done well, project funding (e.g. a vendor not receiving a PO, if you don't fund the project from the vendor side because you didn't have the money available and that end up affecting the time you take to deliver the work), too many quality shortfalls that you have to do rework, labour dispute (within the project team and the community); project manager's competency, lack of communication skills. For site rollout generally, you can easily outrun your schedule, and this is largely a case where the objective or the plan you had from start, you have not met it due to peculiar constraints that you encountered during the implementation. **#D5**. Most often, delays in rollouts are due to delay in material delivery since telecom equipment are not manufactured in-country so we have to import them, there is also delay in physical structures: so, the towercos would have to ready the site for integration which we termed again as RFI (integration as we are installing the telecom equipment on site). So, if the towercos have difficulty dealing with Landlords, getting contracts out to Landlords, it would cause delays in projects, then transmission and radio frequency plan readiness, site permit acquisition from the regulatory, district assemblies, inaccurate time estimate, Inadequate resources, over-specification, poor site management and supervision, land dispute, lack of top management support, lack of communication skills sometimes, delay in obtaining regulatory approvals, not able to deliver equipment on time, approval from the municipal assembly. There could be delay in obtaining regulatory approvals. There is also a situation where vendor is not able to deliver equipment on time which will impact your implementation timeliness i.e. if you have initially to have planned to rollout in a district on the certain date, by mere fact that the equipment you need to do the rollout are not available, you are not able to meet that timeliness. Aside getting approvals from the regulatory agencies, you also need to get approval from the municipal assembly to deploy within their jurisdictions. **#D6**. One of the major factors of site delays is acquisition of that location. Acquisition of that location usually involves (1) getting that a lease for that location and (2) going through the regulatory permit. So, this regulatory permit can bring delays ranging from 1 to 6 months. Poor communication skills, inaccurate time estimate,

AREAS	INTERVIEW GUIDE QUESTIONS	KEY QUOTES
		issues with top management support, late delivery of materials, poor contract management, any form of labour disputes.
COST OVERRUN (CO)	Understanding project cost overrun	**#D1.** When you spend more money on the project than its estimated budget, that is cost overrun **#D2.** This is where scope creep leads to exceeding the project budget **#D3**. Cost overruns is the additional cost beyond the original budget **#D4**. Cost overrun is a situation where a cost you have ascribed to your project is less than what you have finally achieved after delivery the project. Thus; you have exceeded the planned cost of the project or budget. **#D5.** Your actual cost is higher than your original budgeted cost
	Frequency and approximation of cost overrun occurrence	**#D1**. Sometimes **#D2**. Sometimes **#D3.** it rarely goes over budget **#D4**. Sometimes **#D5.** Rarely, we try to always work within our schedule and budget. So, in terms of resources, you would want to get competent resources to do your rollout for you. **#D6.** Sometimes
	Description of project cost overrun impact on delivery of site projects	**#D1.** There was instance it happened but because we realised it was the fault of the customer, we raised to the customer and the customer had to pay for the difference There was instance it happened but because we realised it was the fault of the customer, we raised to the customer and the customer had to pay for the difference. It impacts the schedule of the project and you need to increase resources in order to speed up the project to be able to deliver within the timeliness **#D2**. Every site must pay for itself, so if there is budget overrun and the business case proves positive, we still go ahead. Forex impact can cause a budget overrun. So, you start the project which has 6 months duration, at the start the cedis to dollar was GH₵ 4.0 and in the middle of the project cedis to a dollar becomes GH₵ 4.2 and this is a multimillion project, so 2% forex has a significant impact on the financial burden of the project. **#D3.** This impacts the quality of the projects. In cases where the cost overrun is accepted, this impacts the profit rate of the supplier as well. Telcos, as mentioned earlier are mostly shielded from cost overrun due to business model, they are running with the suppliers. When additional budget is applied for, it means some part of the initial budget is gone unrealised and for that matter part of the value is being lost **#D4.** It affects service quality, availability, capacity and even the revenues that the business itself has to make

AREAS	INTERVIEW GUIDE QUESTIONS	KEY QUOTES
		#D5. With cost overrun, you would not able to meet project objective because you are not able to fund it. **#D6.** A clear example I had is the project we needed to deliver within 6 months and based on some pre-discussions and preplanning, we realised that based on the timeliness we were working in and based on the budget that we had already agreed upon, to beat the timeliness, we needed to bring in some type of connectors and there was a discussion with the project sponsor and because we didn't want to miss the timeliness, we had to exceed the budget by somewhere around $100K. So, we had to bring prefabricated connectors to be able meet a certain installation requirement on site.
	Outline the factors that cause project cost overrun	**#D1**. These factors also involve poor cost estimation, inexperienced contractors, schedule delays, mistake and errors in design **#D2.** Forex impact can cause a budget overrun. So, you start the project which has 6 months duration, at the start the cedis to dollar was Ghs4.0 and in the middle of the project cedis to a dollar becomes Ghc 4.2 and this is a multimillion project, so 2% forex has a significant impact on the financial burden of the project. Limited engagement from project stakeholders, Lack of top management support, Poor stakeholder coordination, Forex exchange or exchange rate, Inflation **#D3.** lack of experience of Contractors, mistakes and errors in design, requirement changes, schedule delay, inadequate planning and scheduling, supplier is unable to commit adequate qualified resources to the project to control the impact on financial performance **#D4**. Inaccurate time and cost estimate, poor stakeholder management, Inadequate planning and scheduling, design errors, changes in materials cost, scope changes or changes in requirements, Project manager's competency, Lack of communication skills, **#D5**. Inadequate planning, competencies of project resources (resources ability to estimate),Inadequate planning, competencies of project resources, poor cost estimates, Gold plating or over-specification, Fluctuation of prices of material, High inflation & interest rates, Labour disputes/work stoppage, Taken insufficient information from end-users (requirement gathering), Unstable organisational environment, Lack of communication skills by which stakeholders can communicate, poor supervision and inspections **#D6**. Lack of Communication skills, Poor contract management, Lack of experience, Mistakes and errors of design
POOR QUALITY	Description of quality metrics in measuring site projects	**#D1.** From the physical installations: you check if cable bending radius is accurate or wrong, installations quality, cleanliness of the site, cable management, unbolting cabinets on the slabs. KPIs from the customer: data throughput should say 5MB, availability of site, quality of the service for instance signalling, clarity of voice calls, call drops etc. Thus; customer is always looking at for the availability, data throughput, call quality etc. for them to satisfy their customers.

AREAS	INTERVIEW GUIDE QUESTIONS	KEY QUOTES
		#D2. There is list of acceptance criteria that we agree with the vendors and the 80% of the acceptance criteria hinges on network quality KPIs. So, from a physical inspection: does it meet the right physical quality from the network point of view, is it meeting all the network KPIs that enhances right user experience. For Fourth Carrier- 3G sites, you need to make sure the user throughput is at the right levels or at least achieving close to 90% theoretical values and also ensure all the radio access quality KPIs are adhere to. So, these are standard network KPIs that you look out for to be able to check to make sure that they all met before you clear the site fully on **#D3.** The model adopted by most operators is an SLA model: where the metrics for quality is based on the given or meeting certain Key performance Indices (KPI). This also goes to the cell level and includes cell availability, call setup times, cell data throughput, MOS (for voice quality), handover success rate among others. Physical quality checks are also conducted to check the quality of installation and materials used such as RF/microwave brackets and poles to check its galvanisation, bolts and nuts, check for rusting and so on and so forth. These are some of the metrics used to measure quality of cell site project **#D4.** On regulatory side; there are metrics of network coverage you need to meet: service availability & quality; Call/network Carrying Capacity; latency or call setup time. For data access or service; data quality or throughput, environmental impact assessment. There are standards you need to adhere to ensure you don't endanger the lives of people who are within the vicinity where the site is located **#D5**. In measuring or accepting cell site that has gone live; we look at availability. The site should be available for the subscribers to be able to initiate a call on. There is throughput benchmark we give to the vendors to meet. The speed: the download and upload speed, Customers should be able to get their signal on this means service is available, Voice clarity: test calls will be done to ensure that the voice is clear, both the receiver and the sender are able to hear from each other there are no cracking sounds in the communication. After a cell site project is done, there are drive tests that are conducted to measure the signal levels, user throughputs, call clarity, call duration to ensure that we don't have drop calls due to signal loss. And then handover as well: handover the network is dimensioned in location area codes or latches as we termed them. So, if you move from one latch to the other, there is supposed to be some form of handover to the receiving latch. If the right definition is done the call will be dropped. **#D6**. In terms of service quality of a project, there two main broad ways with respect to cell site rollout: One is on the physical structural installations of the cell sites and performance impact of the project. On the Physical Structural bit of the project, we need to make sure the tower is well installed, proper health and safety requirement, we need to make sure the equipment is well installed, the power requirement is all met. With the Performance impact bit, every cell site has a target. It is supposed to meet certain coverage and capacity. In this, there are service KPIs that need to be met. These are usually availability of the service, accessibility of the service, retainability of the service etc.

AREAS	INTERVIEW GUIDE QUESTIONS	KEY QUOTES
	*Understanding project poor quality in site project *Frequency and approximation of poor quality occurrence	**#D1**. Poor quality is when an installation of cell site falls below the standard. There was an instance it happened but because we realised it was the fault of the customer, we raised to the customer **#D2.** Site is delivered does not meet all the set service and physical KPIs. It rarely happens **#D3**. If project does not meet its specifications and in some extreme case it can be termed as unfit for its intended purpose. Sometimes **#D4.** Project quality is termed as poor when the characteristics or the purpose for which the project is being delivered are not met. Thus; your project in the end is not fit for purpose. For quality issues, we rarely experience this because partly the regulatory is the benchmark. So, most of the time, anything you are bringing in or even to get the permit to implement requires you to meet the basic quality requirements. So, issues of quality is a bit rare compared to other 2 constraints of schedule and cost **#D5.** Poor quality of a project is the extent to which the outcome of the project does not meet specifications and it is unfit for purpose. . Sometimes: hence the need for drive test to ensure key performance indicators are met **#D6.** Usually happens rarely
	Description of project poor quality impact on delivery of site projects	**#D2.** this is part of the delays that comes with the project. So, it delays the go live date and it is just the matter of going back to fix them. **#D3.** Poor quality will increase the cost as additional site visits are required to rectify quality issues. This also leads to poor customer experience. Poor quality in some cases lead to coverage gaps which can lead to revenue losses for the telcos. If you look at the extreme end, poor quality installation can lead to serious injury or even death from falling antennas or loose bolts **#D4.** In the event I have delivered the project to the acceptance stage which is almost at the closure stage in the life cycle and by checking the benchmark, we realise that the service we are delivering from that site is poor, it means we have to do a rework. So, the cost of the rework is a negative for the investment we are making so that equally affect the value we are delivering. Then there are issues of customer complaints: we are delivering the site to serve the needs of the customers. So, if the customers who you are serving with a new site you have rollout already start having issues, then customers confident and loyalty is eroded. So, the value you again gain from that site is equally impacted by the poor quality of work that you have delivered. Then in terms of infrastructure itself: if I bring in poor quality equipment probably to cut down my initial cost. Rolling that out and having quality issues, straight away could lead me to regulatory fines or customer dissatisfaction and impact on my corporate image. So, it cuts across **#D5.** Poor quality brings about rework which increases the project cost, it leads to loss of customer confident and could result in loss of revenues and customers

AREAS	INTERVIEW GUIDE QUESTIONS	KEY QUOTES
		#D6. There is a time impact and cost impact that would affect you if quality is impacted in any of your project. If there is any quality that is degraded in the delivery of the project, what it means that the acceptance of the project would delay and if it delays one the project timeliness would exceed and then you need to retain resources to be able to fix whatever quality issues that come up.
	Outline the factors that cause poor quality	**#D1.** Poor supervision and site management, Inexperienced project team and engineers, lack of quality assurance and control, Lack of communication skills **#D2.** Contractor incompetence, Unclear KPIs, Pressure to deliver the project, Climate condition at the site **#D3**. Poor communication skills, Lack of quality assurance and control, Incompetence subcontractor or contractors, Scope creeping, Poor supervision, Hostile socio-economic environment, Conflict among project team, Poor working relationship among Team, Lack of Project Manager knowledge, Lack of quality focus **#D4.** Limited information, scope creeps, Poor supervision, Lack of quality assurance and control, gold plating (is a situation where you go beyond the quality plan you have had, thus; deciding it to make the outcome too beautiful than planned), Changing quality needs during project implementation, **#D5.** Lack of quality assurance and control, Poor scope alignment, poor monitoring and control, Unsupportive organisational culture, Poor deliverable quality, Conflicting requirement, Unclear requirements (based on project management recommendations, requirements are supposed to be precise and measurable, so if requirements are not measurable then it becomes difficult to determine whether the quality metrics are met or not), Poor client-vendor relationship, Lack of understanding of end-user requirement, Lack of a quality focus, Lack of communication skills, Poor supervision and site management **#D6.** Lack of quality assurance and control, Scope creeping, faulty project conceptualisation, conflict among project team, Lack of project management knowledge, Lack of quality focus
OUT OF SCOPE	Understanding out of scope of work.	**#D1.** Out of scope is when an activity is being done which is not part of the initial scope definition. Out of scope comes from the customer and such change request must be flagged as out of scope and additional resources need to be demanded so it does not eat into your budget **#D2.** An occurrence of scope creep constitutes out of scope **#D3.** This is when the project outcome is not what is expected **#D4.** The outcome of the deliverables is not exactly what I set up to do
	Frequency of out of scope occurrence in site projects	**#D2** it rarely happens **#D3.** Out of scope happens sometimes **#D4.** Largely never or rarely happens

AREAS	INTERVIEW GUIDE QUESTIONS	KEY QUOTES
		#D5. It rarely happens **#D6**. sometimes
	Description of out of scope of work impact on delivery of site projects	**#D1**. It increases the planned activities for that period because of the additional work and will impact the budget and the overall delivery timeliness. …If I don't get customer's buy-in, I don't affect the change and only execute what we agreed initially in scope. Refusal to pay extra money to cover the additional work is ignored. However, if the change request (out of scope) does not impact project budget or schedule, then it is considered in the implementation and it is done for free for the customer. **#D2**. It can derail the plan so if there is any scope creep it increases the cost. And now the new cost does not make the site fit or pounce the business case, then it becomes challenging, the site would not be done. **#D3**. It will increase cost, also increase the schedule as well. **#D4.** If there are slips in the scope, most of the time it would rather be a scope creep (something that you have not anticipated when you were planning has come in while you are on site and you would have to take care of that else the work cannot go on). Scope creep is usually not out of scope but an expansion of scope and in most cases, they are act of nature or act of God (so there are situations you cannot work around) or else, your quality or the earned value would be impacted. **#D5.** The rework comes in and that is going to impact your schedule and it is going to hit you hard on your books because the cost could be huge **#D6.** With every project, there are a list of activities that are designated and anytime an activity that has not been initially planned and agreed upon comes up, we define it as going out of scope. It prolongs the delivery timeliness and sometimes, there is cost implication that come in
	Outline the factors that cause out of scope of work	**#D1.** Out of scope comes from the customer and such change request must be flagged as out of scope and additional resources need to be demanded so it does not eat into your budget. Out of scope is for example, a customer said we should undertake LTE rollout with a configuration on the LTE site. So, in the course of the implementation, customer realised that configuration would not help them so increase it. As a good project manager, you need to identify this change as out of scope, meet with the customer and demand extra budget to cater for the change. Also, lack of detailed scope, lack of scope management, over-specification. **#D2.** From experience because we have done this over a long period, we have mastered the trade so there is little or no room for creep because budget is hard to come by so there are instances, we try to deliver more within the said budget. So, there is a zero tolerance in scope creep after many years of rollout sites. Scope creep

AREAS	INTERVIEW GUIDE QUESTIONS	KEY QUOTES
		#D3. We go out of scope; this would definitely increase cost and has impact on schedule as well. Lack of detailed scope, lack of stakeholder involvement, poor communication skills, conflicting requirement, over-specification. **#D4**. Most of the time, scope is maintained because that is where the revenue is for instance, in my business case, there is money to be made at a particular location and decide not to cover the location. I am robbing my own self of money. For the scope of work, you must always almost ensure you achieve that. The factors include unclear/ambiguous requirements, Inconsistent process for collecting product requirements in relation to the industry standards, poor scope management, excessive restriction of project budget **#D5.** Out of scope in cell site rollout is essentially what you are delivery is network so rarely do we have a project going out of scope: meaning you can't go beyond delivery a network unless we want to talk about technology here where a scope was to deliver a 2G Network and the vendor decides to deliver a 3G network which rarely happens. Ambiguous scope definition, Lack of stakeholder involvement, Lack of top management support, Inaccurate time and cost estimates, Terrain (project environment), quality of telecom equipment, Non-availability of experienced contractor, Different geographical locations, Poor standard of workmanship, Lack of a quality focus, Lack of communication skills, **#D6**. With every project, there are a list of activities that are designated and anytime an activity that has not been initially planned and agreed upon comes up, we define it as going out of scope. Factors include incorrect requirement, over-specification, Poor communication skills, Conflicting requirement, unclear scope definition
TEAM DISSATIS-FACTION	Definition of project team dissatisfaction	**#D1.** When the project team members are unhappy with the project **#D2.** When project team members are frustrated partly due to lack of earlier engagement **#D3.** When project Team expectations from the projects are not being met **#D4.** Project team dissatisfaction is a situation where the expectation their project team came to the project with are not met **#D5**. Project team members get dissatisfied if their expectations from the project are not being met
	Frequency of team dissatisfaction occurrence in site projects	**#D1**. Sometimes **#D2** Sometimes **#D3**. Sometimes **#D4.** Rarely **#D5**. Sometimes

AREAS	INTERVIEW GUIDE QUESTIONS	KEY QUOTES
		#D6. It rarely happens
	Team dissatisfaction effect on site project	**#D1**. If the team members are not paid well, they are overworked, and they don't get over time or any kind of motivation then they become dissatisfied and do the work anyhow. Project team can be dissatisfied when the team has to work with the Backoffice engineers. Team gets to the site and the Backoffice engineer is not available to support them to work. He keeps the Team on site for long hours can become dissatisfied because working at the site is more difficult than being in office. Because in every project you find one or 2 people within the team who are dissatisfied. it can cause your project delay. **#D2**. It creates conflict, which has a risk of affecting either quality of work or causing delays. Within the project team, there is a project manager and number of subject matter experts within the team. The number of subject matter experts are people that sit in my function, so I will speak for the issues that the subject matter experts face during the project. So basically, subject matter experts would prefer an early engagement to be able to allow them time to provide all the support that is needed in the project. So, in absence of early engagement creates sort of frustrations for them because what then happens is that the project manager starts putting a lot of pressure on them to sort of go out their way to meet the straight deadliness which had occurred because of lack of earlier engagement. So, one of the frustrations that subject matter experts within the project would face is lack of earlier engagement which causes a lot stress and a lot of burden on them put in extra working hours to just to meet said deadliness **#D3**. The quality and schedule are usually impacted as a result of team dissatisfaction. **#D4**. Team dissatisfaction generally affects morale. May not be necessarily the project team itself, because most of the time the project team has a vested interest in the success of the delivery but there are situations where stakeholders like the communities in which you are going to deploy are not just ready to accept that infrastructure coming in. At times, due to low level of education, people feel once you put radio equipment in their vicinity, everybody is going to be impacted with cancer. But stakeholders within the larger community beyond the one who has given you the permit, equally could be dissatisfied with it and you need to manage it. Most of these projects are greenfield, so you move a team to remote areas where there is not even telecom services there to communicate with the families they have left behind. So very serious human sentiments do come in and you need to fall on your personal and human management skills to try to get the team to still Have a team spirit to work with for you. **#D5**. What it does to the team members is because of repeated visit, they become nostalgic, they are unproductive, this affects the schedule because of repeated visit, it affects your cost and team members become exhausted which affects quality of what deliver **#D6.** When there is a team dissatisfaction you have problem with morale, it can really affect your project timeliness ends up leading to delays and slips. Even when sometimes project seems to be missing timeliness,

AREAS	INTERVIEW GUIDE QUESTIONS	KEY QUOTES
		when morale is very high, you are able to push and even go beyond. So anytime, you have problem with morale, it can really affect your project timeliness
	Outline the factors that cause project team dissatisfaction in cell site rollout project	**#D1**. Politics within the organisation and its negative effect, Different geographical location, Lack of top management support, poor client and vendor relationships **#D2**. Lack of earlier team members engagement, Pressure from Project Manager, Extra working hours, Conflicts among project stakeholders **#D3.** Lack of motivation and monetary rewards, Delay in payment to vendors/supplier/subcontractor, Cumbersome organisational processes, Lack of Communication skills, Too many reworks due to poor quality, Lack of top management support, Politicking among team members **#D4**. Poor client-vendor relationship, Corporate politics with negative effect, Delay in payment to vendors/supplier/subcontractor, Poor management of team motivation and motivational drives, excessive changes to project scope, Poor Communication skills of the Project Manager and Team members, Lack of Project manager's competency **#D5.** So mostly scope changes that causes dissatisfactions on project team. Lack of clear scope, scope creep, payment of remuneration, unstable organisational environment where functional managers keep going and coming, project manager's incompetence, commitment among project participants, poor client-vendor relationship, different geographical locations (in our global village, we have working in different time zones), labour changes in organisational management and leadership, usual corporate politics and its negative effect, unsupportive organisational culture, lack of top management support, cumbersome organisational processes, poor client-vendor relationship **#D6.** Sometimes, it can happen because of conflict, and misunderstanding. Changes in organisational management and leadership, Organisational politics, Poor client-vendor relationship, Lack of communication skills

Source: Researcher's construct from field data (2019)

4.5.1 Case analysis Company A – D

Company A

Time overrun: in this case, the findings as presented in Table 4.4 and Appendix 4.2, show that time overrun is the extra time required to complete the project after failing to meet the planned delivery date, as **#D3**, the Programme Director opined: *"time overrun is the additional time spent to complete the project after the originally planned date could not be achieved***.**" With regards to frequency of time overrun's occurrence, the evidence indicates that it does occur sometimes which can go up to two months, although its duration varies from one operator (telco) to the other, based on their internal processes and culture, as the Programme Director further stated:

> *"…1 to 2 months' delays and this varies from an operator to operator. Different operators have different internal processes and different organisational cultures which affect the time overrun."*

The findings further suggest that time overrun has an overall negative effect on a site project as it impacts cost and sometimes results in changes to the project scope resulting in financial impacts to both operator and vendor, as he stated:

> *"Time overrun obviously has negative impact on cell site rollout project and time is a constraint in any project delivery. This will impact the cost, and sometime the scope of the project will change. Time overrun really has huge impact on the cost and the suppliers as well."*

In outlining the factors that cause time overruns during site projects, the findings indicated that as a vendor, the issuance of the purchase order (PO) by the operator (telco) seems the topmost among the reasons why time overrun occurs during site projects, as the Programme Director opined:

> *"….in a case of PO for example, this delays the start of the entire project itself and once the start time is delayed is also impact on time window within which to finish the project and get some returns within the financial year."*

Other factors include: late issuing of POs, too many parties involved in the project, inaccurate time and cost estimates, and inadequate resources, as presented in Table 4.4, Appendix 4.2 and Figure 4.5.

Cost overrun: in this regard, the findings indicate that the extra cost beyond the original budget is considered as cost overrun, as stated by Programme Manager:

“Cost overruns is the additional cost beyond the original budget.” The findings further indicate that from the telco’s (operator’s) perspective, it rarely experiences cost overruns, as such an occurrence is borne by the vendor (contractor), as Programme Manager again opined: *“The scope is usually left on per site basis and the additional cost or the excess budget amount is borne by the Vendor but not the telcos for cost overrun.”*

Additionally, the finding reveals that a cost overrun tends to impact the project schedule affecting both the telco and the vendor, however, financially the vendor tends to suffer the most from cost overruns in the project which affect their profit rate, as the Programme Director stated: *“Telcos, as mentioned earlier are mostly shielded from cost overrun due to business model, they are running with the suppliers*.”

The finding again reveals that the factors that cause cost overruns involve: lack of experienced contractors, inadequate planning and scheduling, and a supplier that is unable to commit adequate qualified resources to the project to control the impact on financial performance, as illustrated in Table 4.4, Figure 5.7 and Appendix 4.2.

Poor quality: the finding shows that when the outcome of the project does not meet its specifications it is considered as poor quality, and in some extreme cases it can be termed as unfit for its intended purpose, as presented in Table 4.4. The finding indicates that the quality metrics are usually defined in the service level agreement (SLA) model between the operator (customer, the telco) and the vendor. These metrics could be categorised into *service accessibility,* such as cell availability, call setup times, cell data throughput, MOS-voice quality, and *physical installation,* such as cable management, unbolting cabinets on the slabs, quality of installation and materials, RF/microwave brackets and poles galvanisation, bolts and nuts, check for rusting, tower and equipment well installed, proper health and safety requirement, and the power requirement, as illustrated in Table 4.4 and Appendix 4.2.

The finding also reveals that cell site projects sometimes experience quality issues which bring about poor customer experiences. Poor quality could increase the project cost, as resources must visit the field to rectify it in the form of rework. It also brings about a coverage gap leading to revenue loss, and the most vital point is that it can result in death, as the Programme Manager asserted:

> *"Poor quality will increase the cost as additional site visits are required to rectify quality issues. This also leads to poor customer experience. Poor quality in some cases lead to coverage gaps which can lead to revenue losses for the telcos. If you look at the extreme end, poor quality installation can lead to serious injury or even death from falling antennas or loose bolts."*

From Table 4.4 and Figure 4.9; the causal factors for poor quality found includes poor communication skills, lack of quality assurance and control, scope creeping, poor supervision, lack of project manager knowledge, and lack of quality focus, and so forth.

Out of scope: the evidence suggests that the unplanned activities being delivered as part of the project sometimes occur during site projects, and this increases project cost and schedule. The evidence further indicates that the causal factors of out of scope includes lack of detailed scope, lack of stakeholder involvement, poor communication skills, conflicting requirement and over-specification, as presented in Table 4.4, Figure 4.11 and Appendix 4.2.

Team dissatisfaction: with regards to this, the finding suggests that team dissatisfaction occurs when project team expectations from the projects are not met, as the Programme Director simply put *it "When project team expectations from the projects are not being met."* From the findings, team dissatisfaction sometimes occurs, which affects the quality and schedule of the site projects, as he further stated: "*the quality and schedule are usually impacted as a result of team dissatisfaction."*

The factors found to cause team dissatisfaction include lack of motivation and monetary rewards, delays in payment to vendors, suppliers, or subcontractors, and cumbersome organisational processes, as illustrated in Figure 4.13.

Company B

Time overrun: the findings from Table 4.4 show that the deviation from the initial plan or additional time to complete the project constitute time overrun, as both **#D4**, and **#D5** stated, respectively: *"time overrun is generally indicating your deviation or exceeding the time you have initially planned to execute your site rollout",* and "*it is essentially the additional time we have to spend to complete a project after the planned delivery date is not achieved."*

In determining whether time overrun is experienced and how it comes about, the finding reveals that time overrun occurs sometimes during site deployment, as **#D4** said: *"it happens often and approximately, 3 to 5 weeks overruns."* Also, from the findings, return on investment with regards to revenue estimation in the business case, as well as team dissatisfaction, seem the overall impact of time overrun as opined by **#D4** and **#D5**, respectively:

> *"There are cases where this leads to team dissatisfaction, because you at times hold people to greenfields that are in very remote area. The team is on-site and very little things are delaying the work and they cannot get to their families."* (Project Manager)

> *"So before one decides to deploy at a location, there would have been a business case to determine what sort of revenues you are going to get and based on that there is time plan on how to meet those targets. So, if I am not able to go live on a certain date, it means the expected revenues do not come and this is the effect of your schedule delay."* (Network Planning Manager)

In outlining the factors that cause time overrun, there are some factors uniquely identified by each of the participants and other factors similarly identified by both participants. **#D4** uniquely outlined factors such as poor scoping, too many quality shortfalls that you have to do rework, and project manager's competency, and **#D5** distinctly indicated factors, such as transmission and radio frequency plan readiness, over-specification, poor site management and supervision. Similarly, they both identified factors such as inaccurate time and cost estimate, lack of communication skills, and land dispute, as presented in Table 4.4 and illustrated in Figure 4.5.

Cost overrun: in line with this, the finding shows that this occurs when the actual cost of work done is higher than the original budgeted cost, as explained by **#D5:**

> *"Your actual cost is higher than your original budgeted cost" and #D4: "Cost overrun is a situation where a cost you have ascribed to your project is less than what you have finally achieved after delivery the project. Thus; you have exceeded the planned cost of the project or budget."*

The evidence suggests that the occurrence of cost overrun has both financial and service impacts. The financial impact includes revenues and capex budget for the year, whereas the service impact involves quality issues, and service availability, as presented in Table 4.4.

In addition, the findings indicate that the participants commonly outlined factors such as inadequate planning and scheduling, changes in materials cost, inaccurate time and cost estimate, poor stakeholder management, lack of communication skills as causing cost overrun. However, **#D4** uniquely identifies factors such as project manager's competency, mistakes and error in design, and so on, and **#D5** distinctly outlines factors such as gold plating or over-specification, high inflation and interest rates, labour disputes/work stoppage, taken insufficient information from end-users (requirement gathering), and unstable organisational environment, as cost overrun causal factors, as illustrated in Figure 5.7.

Poor quality: the finding suggests that outcome of the project is termed poor when the characteristics of the project are not met, as **#D4** stated: *"project quality is termed as poor when the characteristics or the purpose for which the project is being delivered are not met. Thus; your project in the end is not fit for purpose."* The findings further indicate that the metrics that the regulatory requirement is related to includes but is not limited to; expected network coverage, service availability and quality, voice clarity, call/network carrying capacity, and latency or call set up time. There are also other metrics found to measure site project quality, such as data access or service; data quality or throughput, environmental impact assessment, data the download and upload speed, as clarified in Table 4.4.

In outlining the factors that cause poor quality, some factors were commonly identified by both **#D4** and **#D5,** which involve lack of a quality focus, lack of communication skills, and poor supervision and site management. However, the factors that were exclusively identified by each participant include, but are not limited to, poor monitoring and control, unsupportive organisational culture, poor quality deliverables, and conflicting requirements by **#D5**, and limited information, scope creep, poor supervision, lack of quality assurance and control, gold plating, and changing quality needs during project implementation, by **#D4**, as illustrated in Figure 4.9.

Out of scope: with this, the finding explains that when the outcome of project works, or deliverables are not part of what was set up to deliver, as presented in Table 4.4 (see Appendix 4.2 for full details). Out of scope is found as largely never or rarely happens as scope is maintained due to the revenue expectations in the business case (see Table 4.4.). Out of scope is mainly associated with scope creep in site project as opined by #D4:

> *"…if there are slips in the scope, most of the time it would rather be a scope creep (something that you have not anticipated when you were planning has come in while you are on site and you would have to take care of that else the work cannot go on). Scope creep is usually not out of scope but an expansion of scope."* (Project Manager).

The consequence of out of scope on-site project deployment is found to bring about quality issues which require rework. The rework has financial impacts with respect to the cost element, subsequently extending the project schedule, as **#D5** said: *"the rework comes in and that is going to impact your schedule and it is going to hit you hard on your books because the cost could be huge."* From the findings, the causal factors of out of scope distinctly identified by both participants, **#D4** and **#D5**, include unclear/ambiguous requirements, inconsistent process for collecting product requirements in relation to industry standards, poor scope management, excessive restriction of project budget, incorrect requirements, over-specification, and poor communication skills (see Figure 4.10, Table 4.4 and Appendix 4.2).

Team dissatisfaction: the finding presents that project team members become dissatisfied when their expectations from the project are not being met. Team dissatisfaction sometimes occurs which affects team morale, as illustrated in Table 4.4. It usually comes about from the nature of site projects, as **#D4** opined:

> *"Most of these projects are greenfield, so you move a team to remote areas where there are not even telecom services there to communicate with the families they have left behind. So very serious human sentiments do come in."* (Project Manager).

Also, it is revealed that scope changes resulting in repeated visit to the project field mostly causes team dissatisfactions making the team unproductive, which affects the schedule and cost of the project as **#D5** said:

> *"What it does to the team members is because of repeated visit, they become nostalgic, they are unproductive, this affects the schedule because of repeated visit, it affects your cost and team members become exhausted which affects quality of what deliver."*

The causal factors commonly outlined by both participants, **#D4** and **#D5**, are poor client-vendor relationship, poor management of team motivation and motivational drives, project managers' incompetence. However, the unique factors outlined by each participant include excessive changes to project scope, negative effects of corporate politics, and different geographical locations (working in different time zones), as identified by **#D4**, and unsupportive organisational culture, lack of top management support and cumbersome organisational processes, and lack of clear scope, as identified by **#D5** (see Figure 4.12).

Company C

Time overrun: in this view, the finding illustrates that project activities going beyond its initially delivery date result in time overrun, as **#D1**, the Project Manager stated: "*When a project is scheduled to be done within 3 months and it actually takes 4 to 5 months to complete, that is time overrun."* With the frequency of its occurrence, the findings show that time overrun sometimes happen, although a delay falling within 1 to 2 weeks is considered adjustable, but exceeding a month results in increasing costs and resources, as presented in Table 4.4. With regards the impact of time overrun, the findings indicate that time is among the project triple constraints and any deviation from it influences the cost and scope of the project, as illustrated by the Project Manager:

> *"Time overrun has a negative impact on a Cell Sites rollout project because time is one of the three triple constraints and any deviation from the schedule influences the cost and scope of the project to change. When a project delays like that all the other factors come in. Your cost will increase, for example, if you have to spend $20K for a project, delay for a month or 2 can increase your cost to $30K. So, in that, it makes you somehow inefficient in project delivery."*

Moreover, the findings indicate that factors such as lack of top management support, poor contract management, poor monitoring and control, poor scoping, and internal approval processes cause time overruns (see Table 4.4, Figure 4.4 and Appendix 4.2).

Cost overrun: with this the Project Manager indicated that '*when you spend more money on the project than its estimated budget, that is cost overrun'.* The finding reveals that cost overrun happens but the responsibility of bearing the additional cost on the site project depends on which party caused the budget overrun as he further opined: "*…there was instance it happened but because we realised it was the fault of the customer, we raised to the customer and the customer had to pay for the difference."* Again, the finding suggest that cost overrun could impact project schedule and requires more resources as rectification measure to be able to deliver within timelines date as he again stated*: "it impacts the schedule of the project and you need* *to increase resources in order to speed up the project to be able to deliver within the timeliness."*

Lastly, the factors found to cause cost overrun, involve poor cost estimation, inexperienced contractors, schedule delays, mistake and errors in design as illustrated in both Table 4.4, Figure 4.4 and Appendix 4.2.

Poor quality: from the findings, this is simply explained as when an installation of cell site project falls below its standards as exhibited in Table 4.4. Also, the finding reveals that quality metrics for assessing quality performance could be looked at from the physical installation's perspective and customer experience perspective. In view of the installation perspective, metrics, such as accuracy of cabling and installation quality, cleanliness of the site, cable management, and unbolting cabinets on the slabs, among others, are well checked and assessed. From customer's perspective, data throughput, availability of site, quality of the service for instance signalling, clarity of voice calls, and call drops, are examined, as **#D1**, the Project Manager alluded:

> *"From the physical installations: you check if cable bending radius is accurate or wrong, installations quality, cleanliness of the site, cable management, unbolting cabinets on the slabs. KPIs from the customer: data throughput should say 5MB, availability of site, quality of the service for instance signalling, clarity of voice calls, call drops etc. Thus; customer is always looking at for the availability, data throughput, call quality etc. for them to satisfy their customers."*

In assessing frequency of poor quality's occurrence, the finding indicates that it occurs sometimes, but the responsibility is borne by the party that causes it as the Project Manager further opined: *"…there was instance it happened but because we realised it was the fault of the customer, we raised to the customer."*

The factors found from the findings to cause poor quality entails: poor supervision and site management, inexperienced project team and engineers, lack of quality assurance and control, and lack of communication skills as presented in Table 4.4 and Figure 4.4.

Out of scope: the finding shows that any activity that is not part of the initial scope definition is considered out of scope as **#D1**, the Project Manager stated: "*Out of scope is when an activity is being done which is not part of the initial scope definition."* The finding further indicates that from the vendor's perspective, issue relating to out of scope activities are usually initiated by the customer (telcos / telecommunication companies) as he further indicated: "*Out of scope comes from the customer and such change request must be flagged as out of scope and additional resources need to be demanded so it does not eat into your budget."*

The finding again shows that the effect of out of scope is that it extends the duration of planned activities because of the additional work and impacts the budget and the overall delivery timeliness. In dealing with out of scope requests by the telcos, the vendor assesses its impact on budget and schedule. If there is insignificant impact then it is considered in implementation, however, if it has significant impact then the project is halted until customer's buy-in is sought to bear the additional budget requires to complete the project as the Project Manager further opined:

> *"…If I don't get customer's buy-in, I don't affect the change and only execute what we agreed initially in scope. Refusal to pay extra money to cover the additional work is ignored. However, if the change request (out of scope) does not impact project budget or schedule, then it is considered in the implementation and it is done for free for the customer."*

The key causal factors of out of scope found from the findings are lack of detailed scope, lack of scope management and over-specification, as seen in Table 4.4.

Team dissatisfaction**:** from the findings, this is explained as project team members that are unhappy with the project. This happens sometimes as in every project, at least 2 people within the team are dissatisfied as **#D1** stated: *"…because in every project you find one or 2 people within the team who are dissatisfied."* Additionally, the finding shows that team dissatisfaction can cause project delay, mostly resulting from misalignment or disintegration between the field team and the Backoffice team, as **#D1** further illustrated:

> *"If the team members are not paid well, they are overworked, and they don't get over time or any kind of motivation then they become dissatisfied and do the work anyhow. Project team can be dissatisfied when the team has to work with the Backoffice engineers. Team gets to the site and the Backoffice engineer is not available to support them to work. He keeps the Team on site for long hours can become dissatisfied because working at the site is more difficult than being in office."*

The findings in terms of the causes of team dissatisfaction include politics within the organisation, different geographical locations, lack of top management support and poor client and vendor relationships, as presented in Table 4.4 and Figure 4.4.

Company D

Time overrun: the findings postulate that once project delivery time is missed then time overrun occurs, which apparently, happens sometimes for a duration of 3 to 4 weeks during site project deployment, as **#D2** stated:

> *"every project has a set time that has to be completed. It has a start time and a finish time, once the finish time is missed then there is an occurrence of time overruns. … sometimes, which can go up to 3 to 4 weeks if the right permitting gets."* (Network Planning Director)

The findings further suggest that time overrun has a financial impact, as stated by both **#D6,** Head, Radio Frequency Planning & Optimisation: "*It means what you planned getting, within a period of time would not be realised which would have financial impact on the company",* and **#D2**: "*You start deriving revenues from the site the moment the site goes on air. Let's say the site is supposed to give you a monthly revenue of Ghs10K so for every 4weeks delay, it is GHs10K lost."*

Furthermore, the findings reveal that both participants, **#D2** and **#D6**, commonly outlined factors that cause time overruns, such as issues with top management support, delay from the vendor side in importing the hardware into the country, and poor communication skills. Nevertheless, some factors were found which are unique to each participant, and these include, among others, the non-availability of project contractors, delay in seeking budget approval, delay in clearing the hardware from the port, delay in preparing the sites by the tower companies, inaccurate time estimates, poor contract management and any form of labour disputes, as presented in Table 4.4 and Figure 4.5.

Cost overrun: from the findings, **#D2** simply puts cost overrun as scope creep that leads to exceeding the project budget (see Table 4.4 and Appendix 4.2). Also, the findings indicate that forex or exchange rate also brings about cost overrun which has a significant impact on the financial burden of the project, as **#D2** stated:

> *"Forex impact can cause a budget overrun. So, you start the project which has 6 months duration, at the start the cedis to dollar was Ghs4.0 and in the middle of the project cedis*

> *to a dollar becomes Ghc4.2 and this is a multimillion project, so 2% forex has a significant impact on the financial burden of the project."* (Network Planning Director)

Furthermore, a site project is found to sometimes experience cost overrun due to external factors. However, the company's strategic decision sometimes inflicts cost overrun on site projects, as exemplified by **#D6:**

> *"A clear example I had is the project we needed to deliver within 6 months and based on some pre- discussions and preplanning, we realised that based on the timeliness we were working in and based on the budget that we had already agreed upon, to beat the timeliness, we needed to bring in some type of connectors and there was a discussion with the project sponsor and because we didn't want to miss the timeliness, we had to exceed the budget by somewhere around $100K. So, we had to bring prefabricated connectors to be able meet a certain installation requirement on site."*

Stated differently, the finding indicates that although cost overrun has a financial impact on a site project's expected revenue projections, however, if a self-inflicted cost overrun is supported by the revenue projections in the business, it will be accepted by the business, as **#D2** opined: "*every site must pay for itself, so if there is budget overrun and the business case proves positive, we still go ahead."*

Again, the key causal factors of cost overrun uniquely outlined by each participant include poor contract management, mistakes and errors in design, and poor/lack of communication skills by **#D6**, and limited engagement from project stakeholders, lack of top management support, and high inflation by **#D2** (see Figure 4.7).

Poor quality: the findings indicate that when the delivered site does not meet all the set service and physical key performance indicators (KPIs) then it is termed as poor quality, which rarely happens, as presented in Table 4.4. The findings suggest that site quality metrics are two-fold: (i) physical structural installations which cover tower installation quality, proper health and safety requirement, meeting all power requirement, and (ii) service performance quality metrics, which are the availability of the service, accessibility of the service, and retainability of the service (are you able to continuously use the service). These quality metrics are also known as network quality metrics, as illustrated by **#D6**:

> *"In terms of service quality of a project, there two main broad ways with respect to cell site rollout: One is on the physical structural installations of the cell sites and performance impact of the project. On the Physical Structural bit of the project, we need to make sure the tower is well installed, proper health and safety requirement, we need to make sure*

> *the equipment is well installed, the power requirement is all met. With the Performance impact bit, every cell site has a target. It is supposed to meet certain coverage and capacity. In this, there are service KPIs that need to be met. These are usually availability of the service, accessibility of the service, retainability of the service, etc."*

The findings also reveal that poor quality has both schedule and financial impacts and going live with the site would be delayed, as **#D6** further stated:

> *"if there is any quality that is degraded in the delivery of the project, what it means that the acceptance of the project would delay and if it delays one the project timeliness would exceed and then you need to retain resources to be able to fix whatever quality issues that come up."*

The causal factors of poor quality found as uniquely identified by the participants include: contractor incompetence, unclear KPIs, excessive pressure to deliver the project, climate condition at the site, lack of quality assurance and control, scope creeping, faulty project conceptualisation, conflict among project team, and lack of quality focus, as illustrated in Table 4.4, Figure 4.9 and Appendix 4.2.

Out of scope: from the findings, an occurrence of scope creep constitutes out of scope (see Table 4.4 and Appendix 4.2). Although, scope creep rarely happens because the years of experience gained in this case on site projects made little or no room for its occurrences as **#D2** alluded:

"From experience because we have done this over a long period, we have mastered the trade so there is little or no room for creep because budget is hard to come by so there are instances, we try to deliver more within the said budget. So, there is a zero tolerance in scope creep after many years of rollout sites." (Network Planning Director)

The occurrences of out of scope have financial impacts in terms of business case estimations and prolonging delivery timeliness, as **#D6** stated: *"It prolongs the delivery timeliness and sometimes, there is cost implication that come in."* Both participants identified out of scope's causal factors as incorrect requirements, over-specification, poor communication skills, conflicting requirement, unclear scope definition, but the key among these is scope creep, as illustrated in Table 4.4 and Figure 4.11.

Team dissatisfaction: in line with this, the finding shows that lack of earlier team engagement results in team dissatisfaction, as **#D2** opined: "*when project team members are frustrated partly due to lack of earlier engagement*." From the findings, team dissatisfaction happens sometimes during site project deployment which affects the team morale and can lead to delays as well as quality issues, as **#D6** stated:

> *"when there is a team dissatisfaction you have problem with morale, it can really affect your project timeliness ends up leading to delays and slips. Even when sometimes project seems to be missing timeliness, when morale is very high, you are able to push and even go beyond. So anytime, you have problem with morale, it can really affect your project timeliness."*

The findings further indicate that the factors that cause team dissatisfaction involves lack of earlier team members engagement, excessive pressure from project manager, extra working hours, conflicts among project stakeholders, changes in organisational management and leadership, organisational politics, poor client and vendor relationship (see Table 4.4, Figure 5.13 and Appendix 4.2)

4.5.2 Cross-case analysis: Measures and factors of value leaks

4.5.2.1 Time overruns

The description of time overrun across the cases suggests that it is the additional time used to complete the project activities after missing out on the initial finish date as illustrated in Figure 4.5.

With regards to specific cases, in Company **A**, it is additional time spent to complete the project. In Company **B**, it is the deviation or exceeding planned duration. In Company **C**, it is going beyond the delivery date. In Company **D**, it occurs once the delivery date is missed.

Also, the findings across the cases suggest that although time overruns do sometimes occur, its duration depends on the specific case. In Company **A**, a delay of 1 to 2 months varies from operator to operator. In Company **B**, it happens often, lasting from 3 to 5 weeks. In Company **C**, it sometimes lasts 1 to 2 weeks. In Company **D**, it can sometimes go up to 3 to 4 weeks. In addition, the effect of time overrun found across the cases, suggests that it has a financial impact for both the operator (telco) and the vendor (contractor). Similarly, it delays the project go-live date, increases project cost, team dissatisfaction sets in, and the overall repercussions are loss of revenue and value (see Table 4.4 and Figure 4.5). In view of individual case's assertions, in Company **A**, it causes cost and scope to change which has a huge impact on cost and suppliers. In Company **B**, delays impact the expected revenue. In Company **C**, it increases cost. In Company **D**, it has a financial impact on the company.

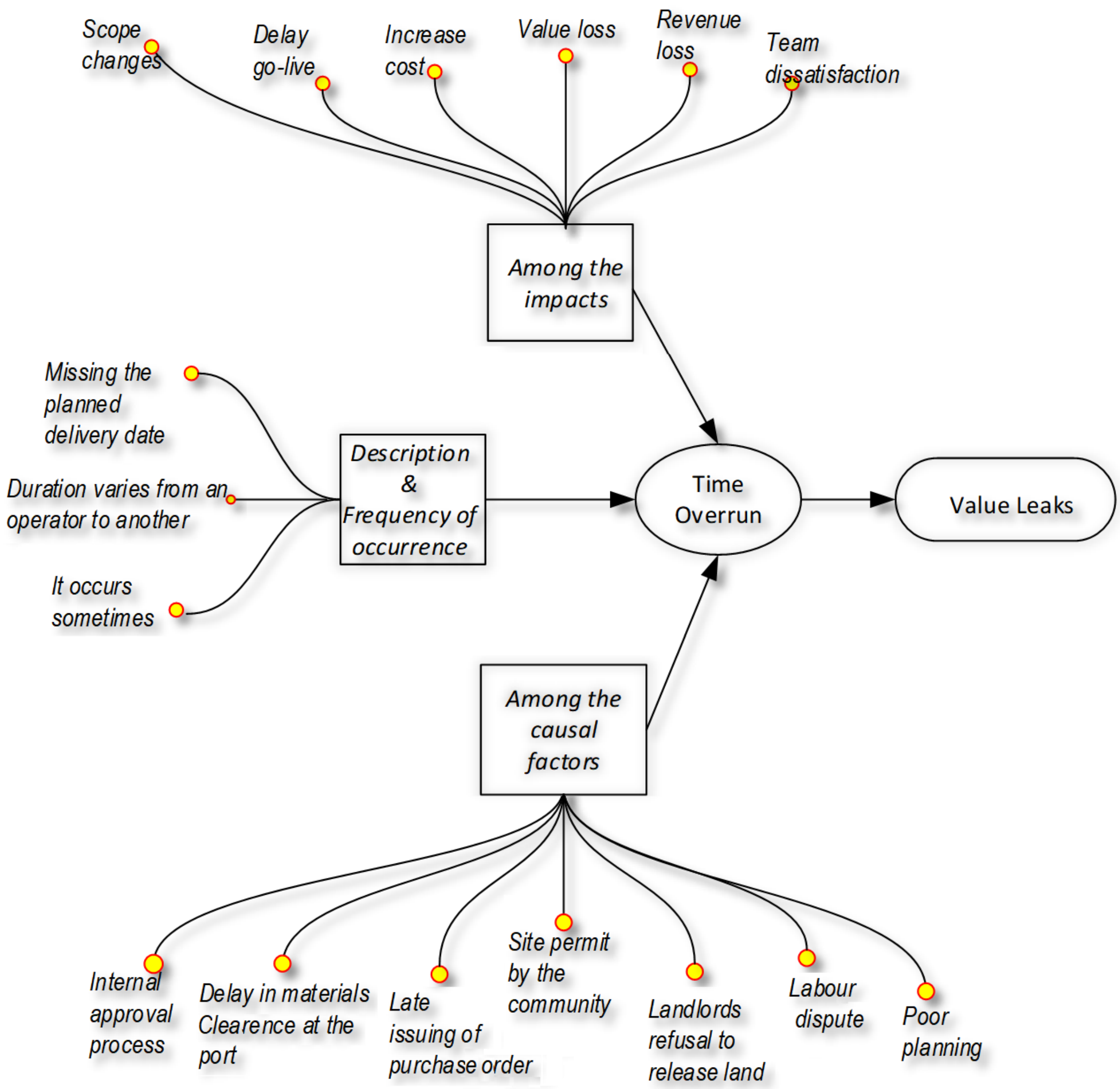


Figure 4.4: Elements derived from the narratives on time overrun

Source: Researcher's construct from field data (2019)

In assessing the factors that cause time overrun during site projects, the participants across the cases operationally expressed factors differently, but some factors are similar in practical meaning across the telecommunication industry. In this regard, a *Model-Cage for Time Overrun diagram* was developed, as shown in Figure 4.5, to demonstrate the similarities and differences among the identified causal factors across all the cases.

In line with this diagram, some factors are found to be unique to specific companies. Specifically, Company **A** distinctly outlines late issuing of POs, too many parties involved in the project, and organisational cultures. Company **B** also uniquely indicates poor planning, too many quality shortfalls that have to be reworked, project manager's competency, transmission and radio frequency plan readiness, over-specification, poor site management and supervision. Company **C** distinctly outlines poor monitoring and control, while Company **D** outlines delays in seeking budget approval and delays in clearing the hardware from the port (see Figure 4.5).

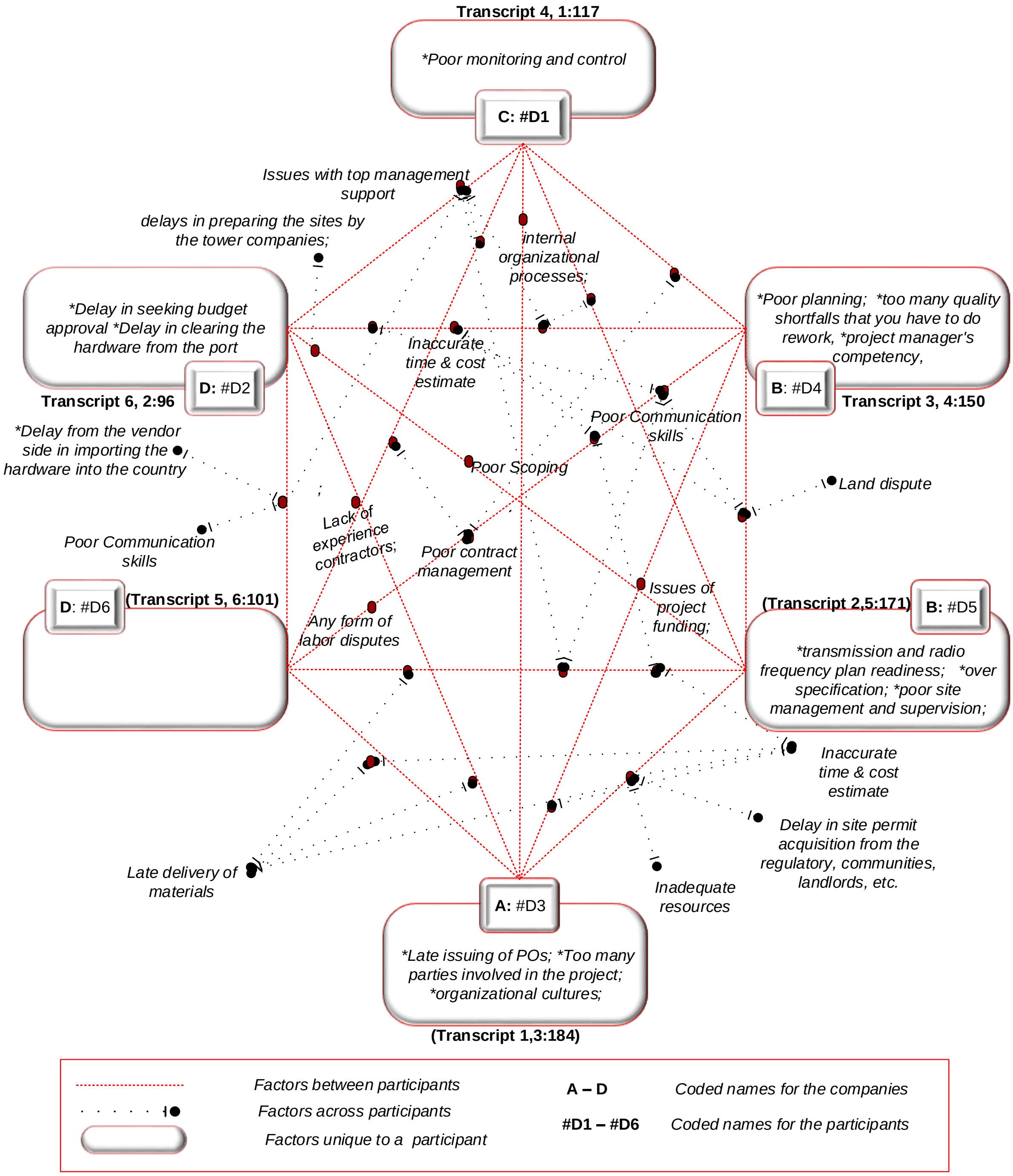


Figure 4.5: Model-cage for Time Overrun causal factors

Source: Researcher's construct from field data (2019)

There are other factors that are similar in meaning across the telecommunication industry. These factors are found in two or more different companies. The factors across two different companies include *inadequate resources, delay in site permit acquisition from the regulatory, issues of project funding, communities, landlords*, as found in Companies **A** and **B**. The factors found in Companies **A** and **D** involve *lack of experienced contractors,* whilst *internal organisational processes* appeared in Companies **A** and **C**. In addition, *delay from the vendor side in importing the hardware into the country, any form of labour disputes, poor communication skills and delays in preparing the sites* by *the tower companies* appeared in Companies **B** and **D**. Further, the factors found in three different companies include: *late delivery of materials* and *inaccurate time and cost estimate,* which were identified in Companies **A**, **B** and **D**; while *poor contract management* appeared in Companies **B**, **C** and **D**, and *poor scoping* was found in Companies **A**, **B** and **C** (see Figure 4.5).

4.5.2.2 Cost overruns

The general assertion across the cases suggests that cost overrun can be seen as spending more money on the project than its estimated budget, as shown in Figure 4.6. In Company **A**, it is additional cost beyond the original budget. In Company **B**, actual cost is higher than budgeted cost. In Company **C**, spending more money than estimated budget. In Company **D**, scope creep leads to exceeding the project budget.

Another impression is that site projects do indeed sometimes go over budget, as seen in the majority of cases presented in Table 4.4. Also, cost overrun (over-budget) is seen as having a financial impact with respect to revenue realisation by the operator and the profit rate of the supplier, as well as having a service quality impact (see Table 4.4, Figure 4.6 and Appendix 4.2).

In Company **A**, it impacts the profit rate of the supplier. In Company **B**, it affects service quality, availability, and expected revenues in the business case. In Company **C**, it may impact the project schedule. Nevertheless, in Company **D,** due to a strategic decision, cost overrun is sometimes caused deliberately by the company in order to achieve their strategic objectives.

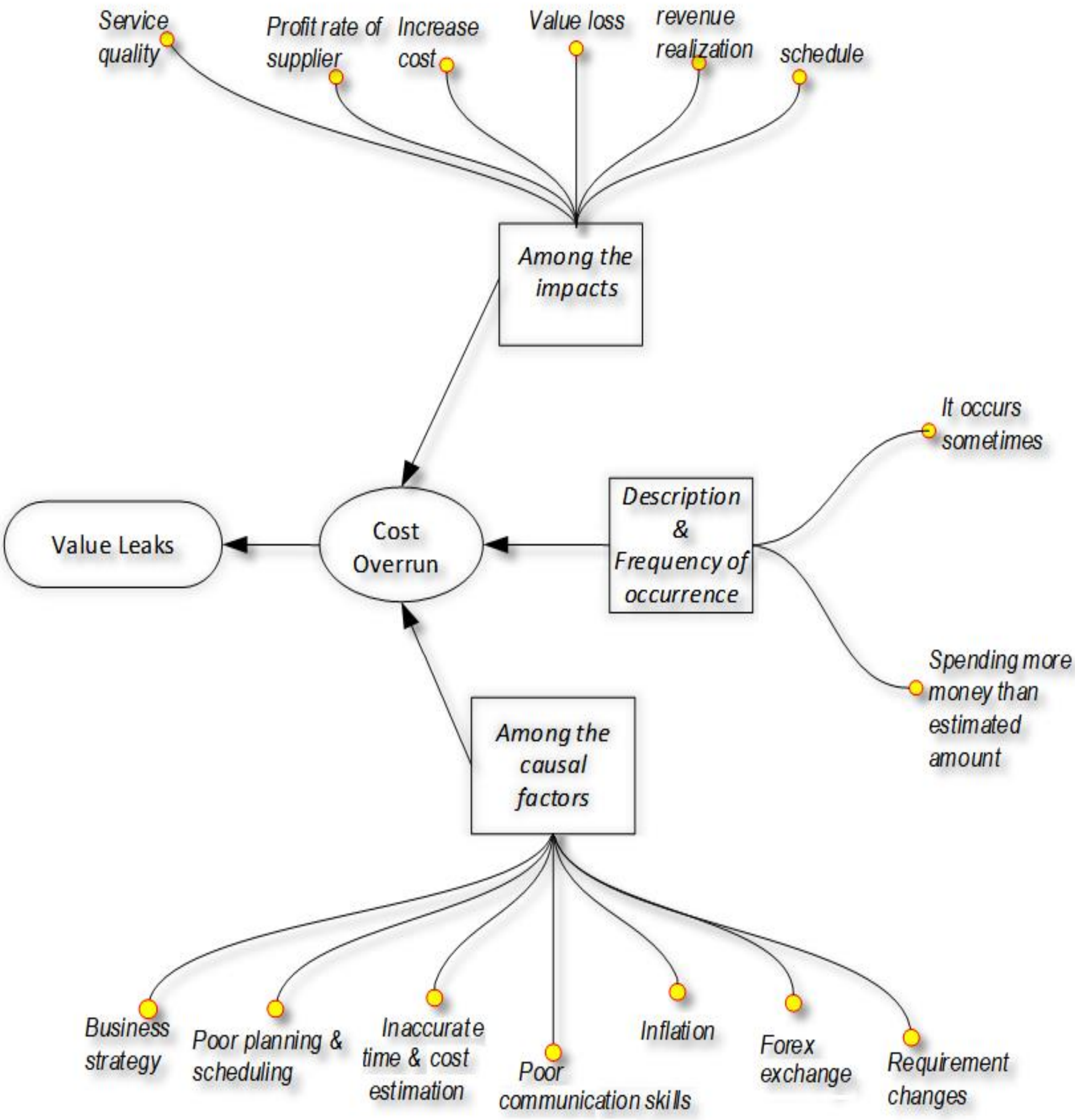


Figure 4.6: Elements derived from the narratives on cost overrun

Source: Researcher's construct from field data (2019)

As with the factor of time overrun, a Model-cage for Cost Overrun diagram was developed for cost overrun causal factors to illustrate the differences and similarities across the cases, as shown in Figure 4.7 below.

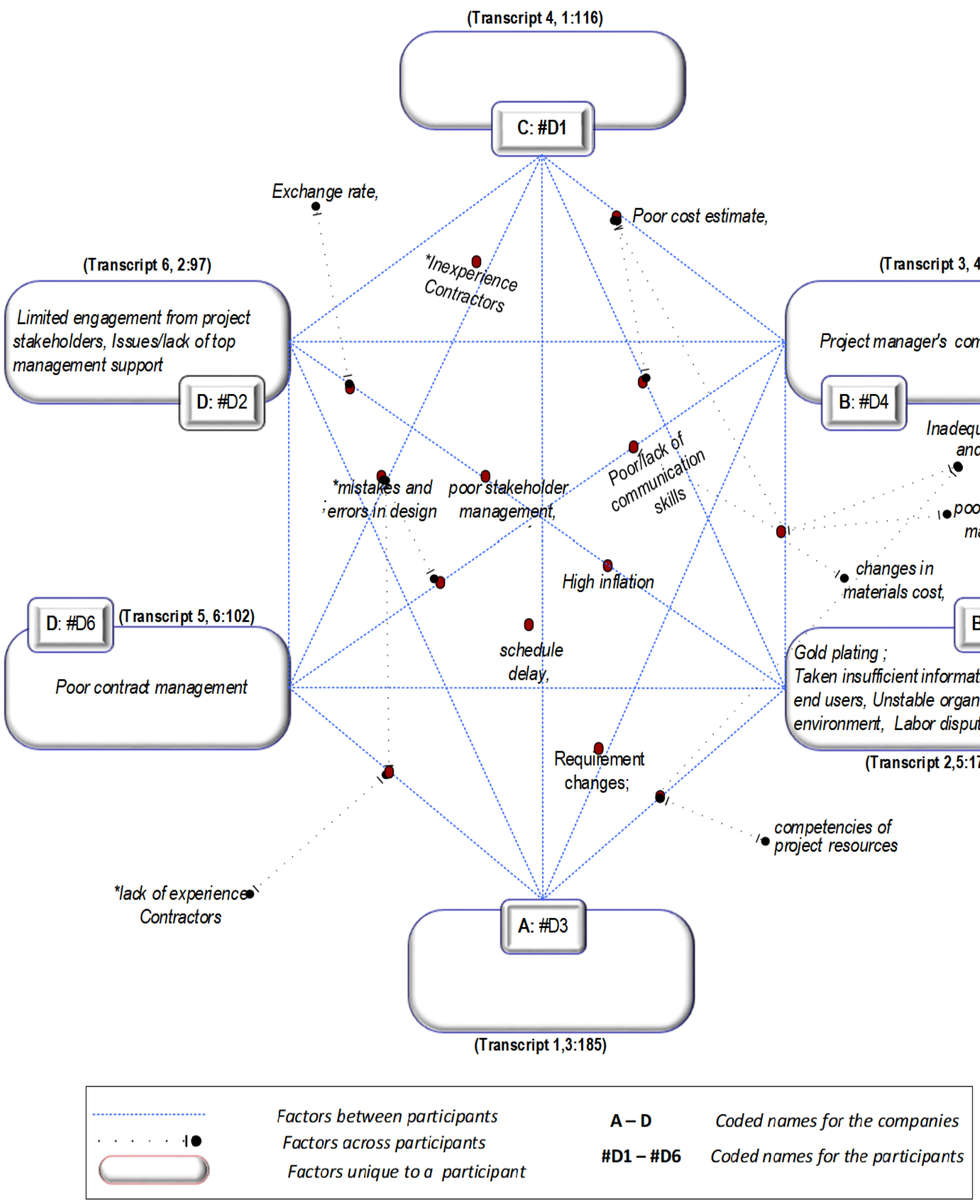


Figure 4.7: Model-cage for Cost overrun causal factors

Source: Researcher's construct from field data (2019)

Delving into these factors as in the figure above, some of them are only associated with a specific company, and these include: *gold plating; taken insufficient information from end-users, unstable organisational environment, labour disputes, and project manager's competency,* which are all found in Company **B**. Also, these factors; *limited engagement from project stakeholders, lack of top management support, and poor contract management* are found in Company **D**. No factors were found distinctive to Company **A** and **C** (see Figure 4.3).

Conversely, the inter-connections and linkages among the causal factors represent the similarities across the companies. In view of this, the factors appearing in two different companies involve: *competencies of project resources, poor/lack of communication skills, exchange rate and high inflation,* all found in Company **B** and **D**; *requiremen*t *changes* and *inadequate planning and scheduling* appeared in Company **A** and **B**; *and schedule delay* is found in Company **A** and **C**. More so, the factor found in three different companies (Company **A**, **C** and **D**) is *lack of experienced contractors* (see Figure 4.7).

4.5.2.3 Poor quality

From the abridged findings as presented in Table 4.4 and summarised in Figure 5.8 (see Appendix 4.2 for full details), the issues of quality within the telecommunication sector are considered very important in all spheres of projects. In view this, poor quality in site project is considered across the cases as a situation whereby the outcome of project does not meet the physical installation and the network performance KPIs. In Company **A**, project does not meet its specification. In Company **B**, the characteristics of project are met. In Company **C**, installation of cell site fails below standard. In Company **D**, set service and physical KPIs are not met.

The evidence suggests that the quality metrics used to assess the quality of delivery site projects across the cases can be classified under: (i) Physical Structural Installation (PSI) Metrics, which are the accuracy of cable bending radius, cleanliness of the site, cable management, unbolting cabinets on the slabs, quality of installation and materials, RF/microwave brackets and poles galvanisation, bolts and nuts, check for rusting, tower and equipment well installed, proper health and safety requirement, and the power requirement, and (ii) Network Performance/Regulatory (NPR) Metrics, which looks at (a) the service availability metrics (Call/network carrying capacity, quality of signalling or network reception, availability of site, data experience, receiving latching onto the network); (b) service accessibility metrics (data throughput, clarity of voice calls, call drops, call setup times, the speed for the download and upload, latency, signal loss and (c) retainability of the service, which is the ability to continuously use the service at all time, as demonstrated in Figure 4.8 which culminates into the development of the models in Chapter 6.

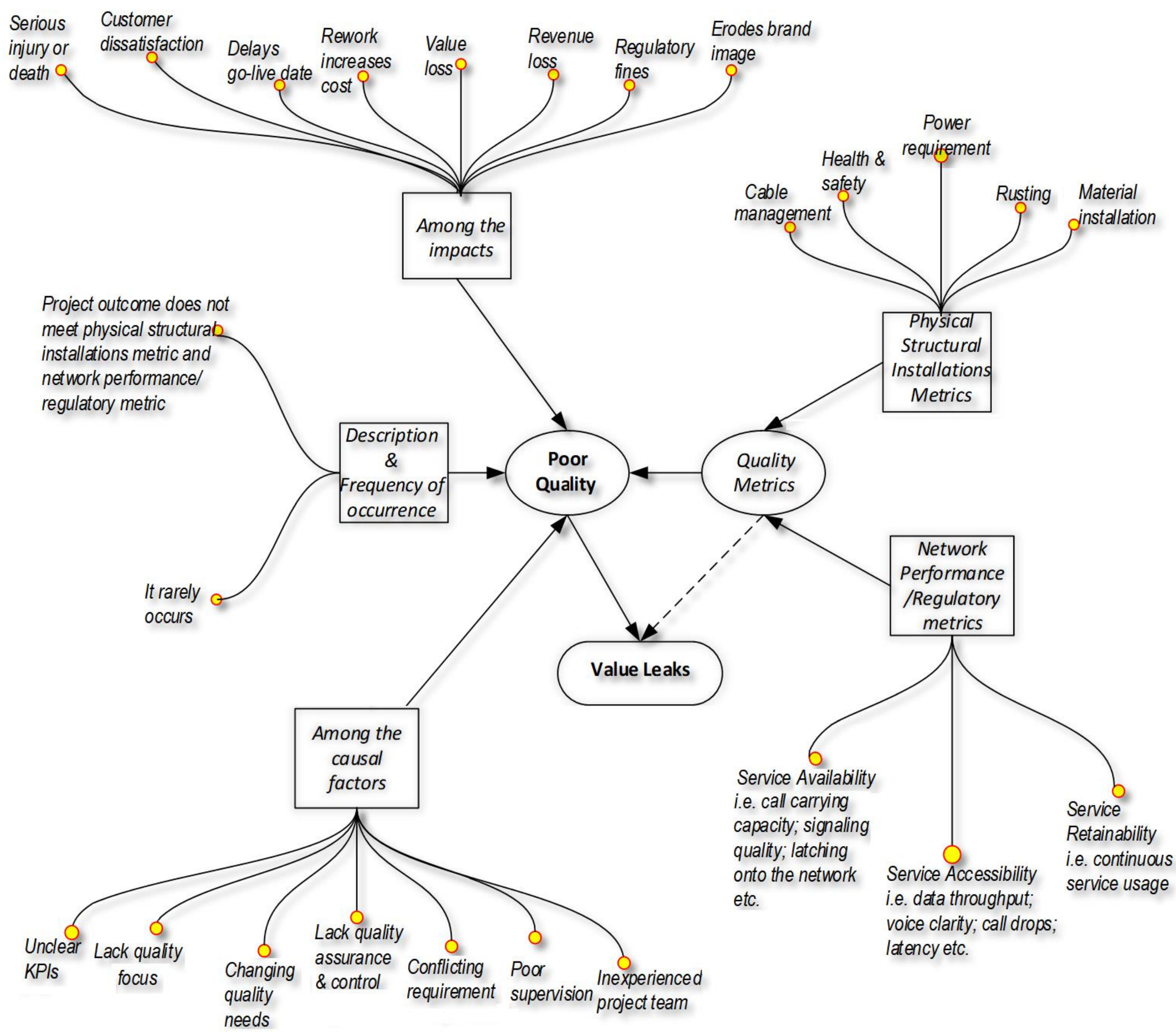


Figure 4.8: Elements derived from the narratives on poor quality

Source: Researcher's construct from field data (2019)

With regards to specific cases: in Company **A**, the cell level includes cell availability, call setup times, cell data throughput, MOS (for voice quality), handover success rate among others. Physical quality checks are the quality of installation, RF/microwave brackets and poles to check its galvanisation, bolts and nuts, and checking for rusting.

In Company **B**, the regulatory side refers to service availability and quality, call/network carrying capacity, latency or call setup time. For data access or service; data quality or throughput, environmental impact assessment.

In Company **C**, physical installations: check if cable bending radius is accurate or wrong, installations quality, cleanliness of the site, cable management, unbolting cabinets on the slabs. KPIs from the customer; availability of site, quality of the service for instance signalling, clarity of voice calls, and call drops. Thus, the customer is always looking for the availability, data throughput, and call quality for them to satisfy their customers.

In Company **D**, the physical structural refers to the proper health and safety requirements, equipment that is well installed, and meeting all the power requirements. In terms of performance, the availability of the service, accessibility of the service, and retainability of the service.

From the findings, it is clear that although poor quality rarely occurs, when it does, its repercussions are disastrous as it brings about rework which increases the project cost, leads to poor customer experience, regulatory fines, customer dissatisfaction, impact on corporate image, extending the go-live date, and at the extreme end, a poor quality installation can lead to serious injury or even death from falling antennas or loose bolts, as presented in Table 4.4 and Figure 4.8.

Similar to the aforementioned, a Model-cage for Poor Quality diagram was developed to ascertain the similarities and differences among the causal factors found to cause poor quality across all the participants as exhibited in Figure 4.9. The factors found to have uniquely been identified by individual companies are: *hostile socio-economic environment* by Company **A**; Company **B** outlines poor *monitoring and control, unsupportive organisational culture, poor deliverable quality, conflicting requirement; poor scope alignment, limited project information, gold plating; changing quality needs during project implementation;* Company **C** states *inexperienced project team and engineer;* and Company **D** outlines *pressure to deliver the project, climate condition at the site, poor project conceptualisation*.

Notwithstanding, the factors that are commonly outlined across two different cases are: Company **A** and **B** outlined *poor working relationship among team;* Company **A** and **D** indicates *conflict among project team, lack of project management knowledge, incompetence subcontractor or contractors;* and Company **B** and **D** stated *unclear KPIs (requirements*). Similarly, the factors that appeared in three different companies: Company **A**, **B** and **D** outlined *lack of quality focus;* Company **A**, **B** and **C** indicated *poor supervision and site management*, *scope creep;* Company **A**, **C** and **D** listed *poor communication skills, lack of quality assurance and control;* Company **A, B, C** and **D** as illustrated in Figure 4.9.

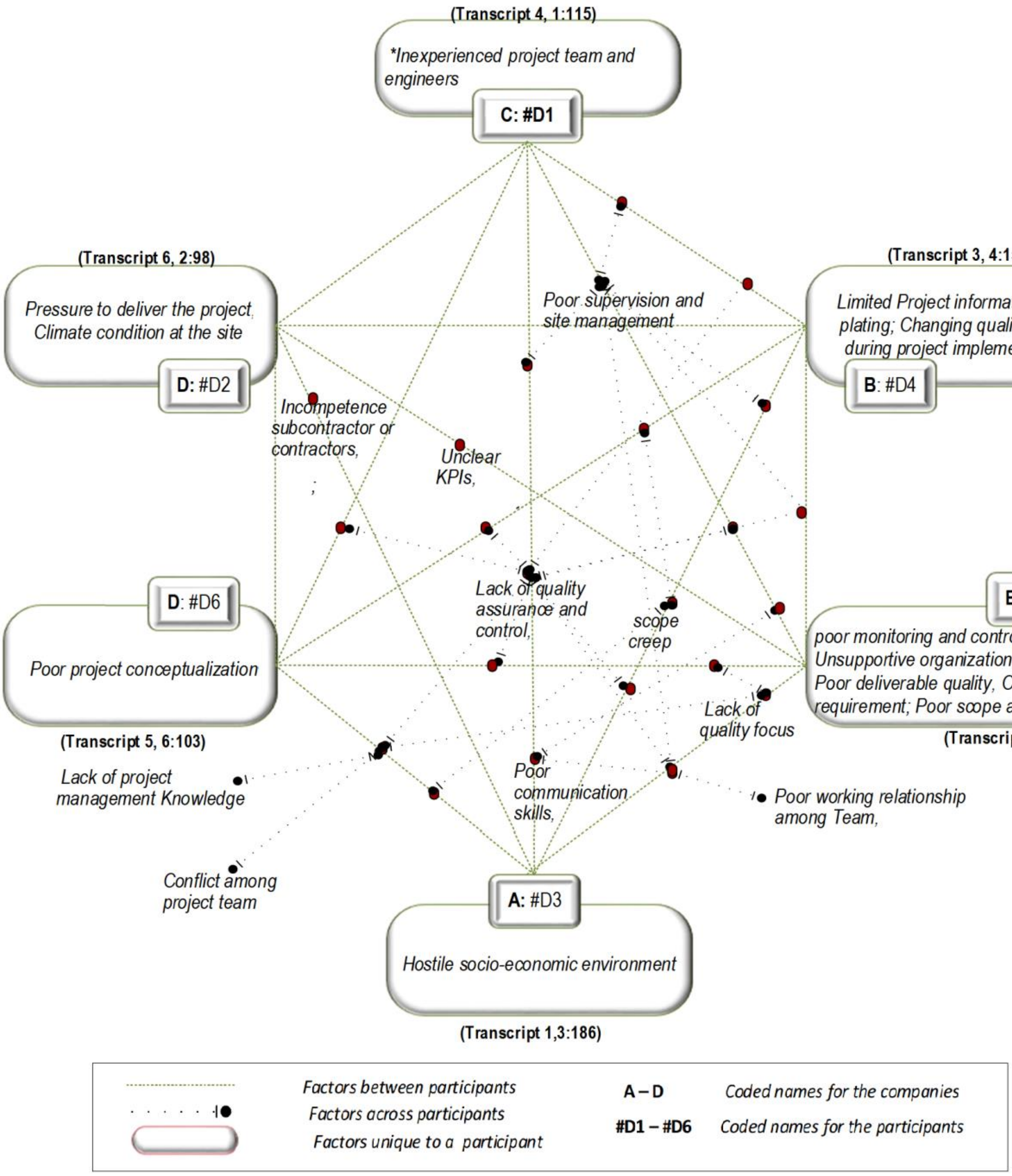


Figure 4.9: Model-cage for Poor Quality causal factors

Source: Researcher's construct from field data (2019)

4.5.2.4 Out of scope

In appreciating the participants' understanding of out of scope, the finding across the cases points to the fact that 'out of scope' is used synonymously with 'scope creep', thus, it refers to the inclusion of project activities which are not part of the initial scope definition, as illustrated in Table 4.4 and Figure 4.10.

In Company **A**, the project outcome is not what is expected. In Company **B**, outcome of the deliverables is not part of what is set up. In Company **C**, an activity is being done which is not part of the initial scope definition. In Company **D**, scope creep constitutes out of scope. The findings indicated that this rarely happens during a cell site project. It was found that out of scope usually comes from the contracting operator (telco), so, a vendor's failure to recognise additional request by the operator (telco) as a change request constitutes out of scope or scope creep, as Company C stated in Table 4.4.

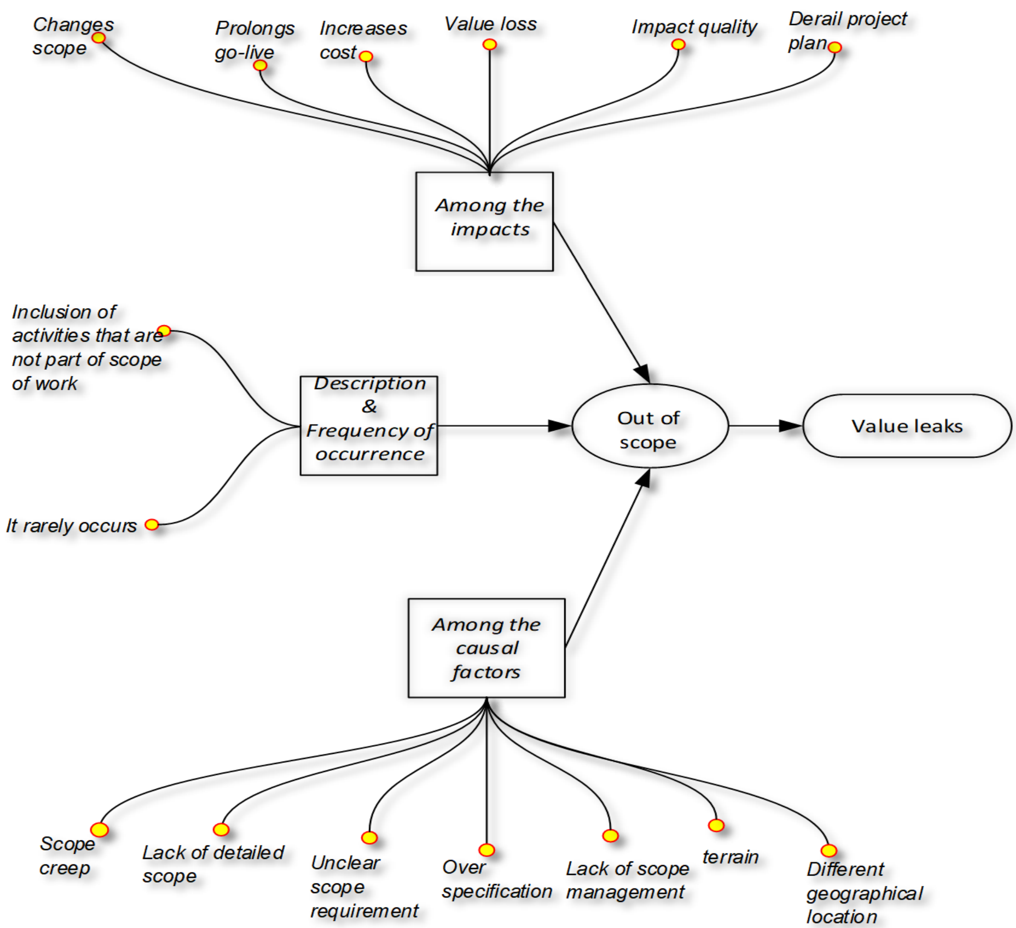


Figure 4.10: Elements derived from the narratives on Out of scope

Source: Researcher's construct from field data (2019)

The finding across the cases further indicate that the effect of out of scope on site project increases project cost, impacts quality, and prolongs delivery timeliness resulting in value loss (see Figure 4.10). Specifically, in Company **A**, it increases cost and extends the schedule. In Company **B**, rework comes in, impacts schedule, cost could be huge, and scope expands. In Company **C**, impacts budget and delivery timeliness. In Company **D**, it prolongs delivery timeliness and cost.

In line with the factors that cause out of scope during site projects, *a Model-cage diagram for Out of scope* was developed to show the similarities and differences among the identified causal factors across all the cases, as shown in Figure 4.11.

The factors found exclusively to a specific case: Company **B** outlines *excessive restriction of project budget, lack of top management support, terrain (project environment), non-availability of experienced contractor, different geographical locations*; and Company **D** indicates *scope creep*. But no factors were found unique to Company **A** and **C**.

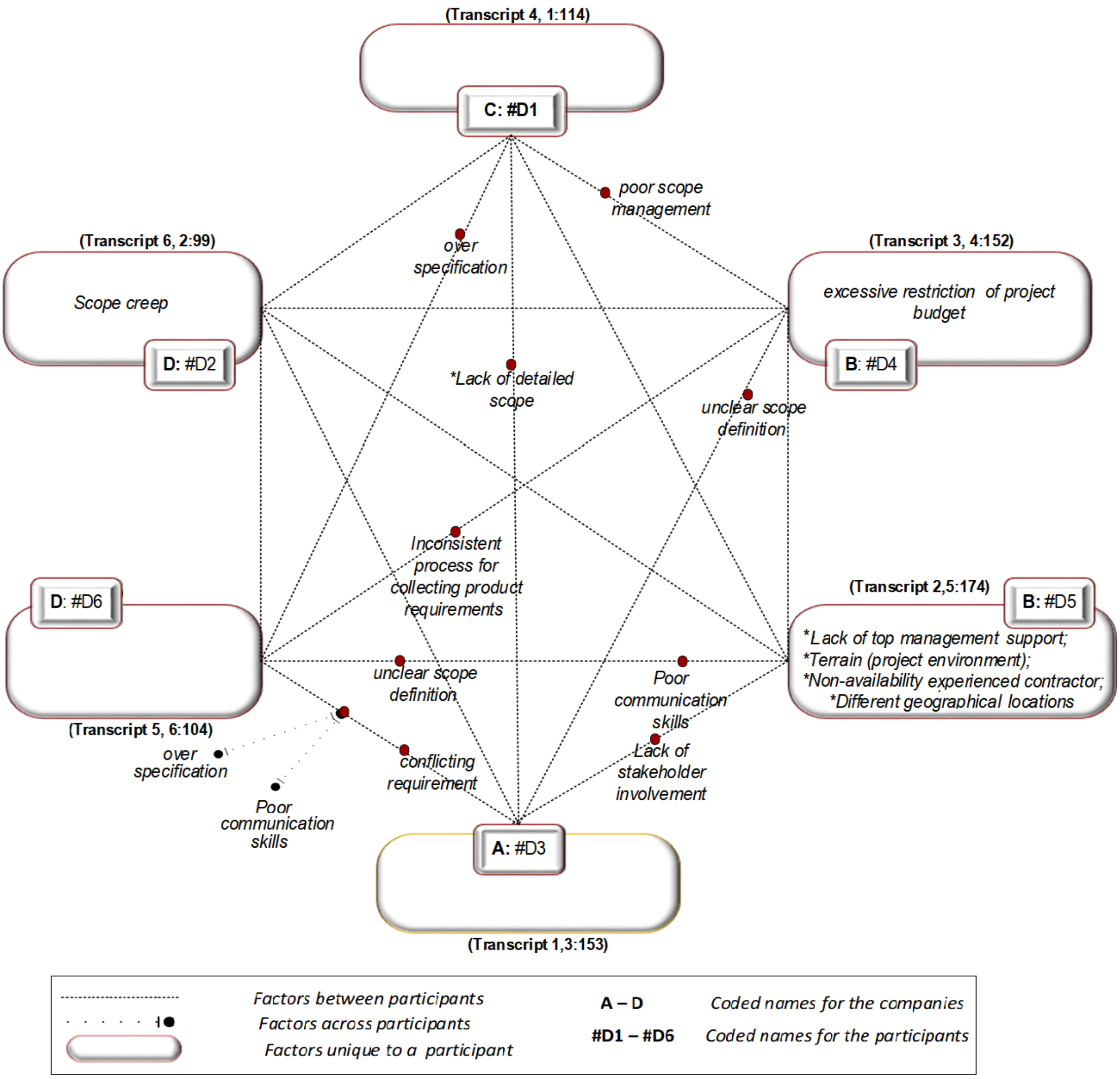


Figure 4.11: Model-cage for Out of scope causal factors

Source: Researcher's construct from field data (2019)

Nevertheless, the factors found from multiple companies are illustrated as: Company **A** and **D** indicate *conflicting requirement;* Company **A** and **B** provide *lack of stakeholder involvement;* Company **B** and **D** outline *unclear scope definition, inconsistent process for collecting product requirements*; Company **A** and **C** indicate *lack of detailed scope;* Company **B** and **C** outline *poor communication skills.*

The factors found from three different companies are illustrated as: Company **A**, **B** and **D** outline *poor communication skills;* and Company **A**, **C** and **D** provide *over-specification,* as demonstrated in Figure 4.11.

4.5.2.5 Team dissatisfaction

Team dissatisfaction is commonly explained across the telecommunication industry as a situation where the project team members are unhappy, as their expectations from the projects are not met, as presented in Table 4.4, Appendix 4.2 and exhibited in Figure 4.12.

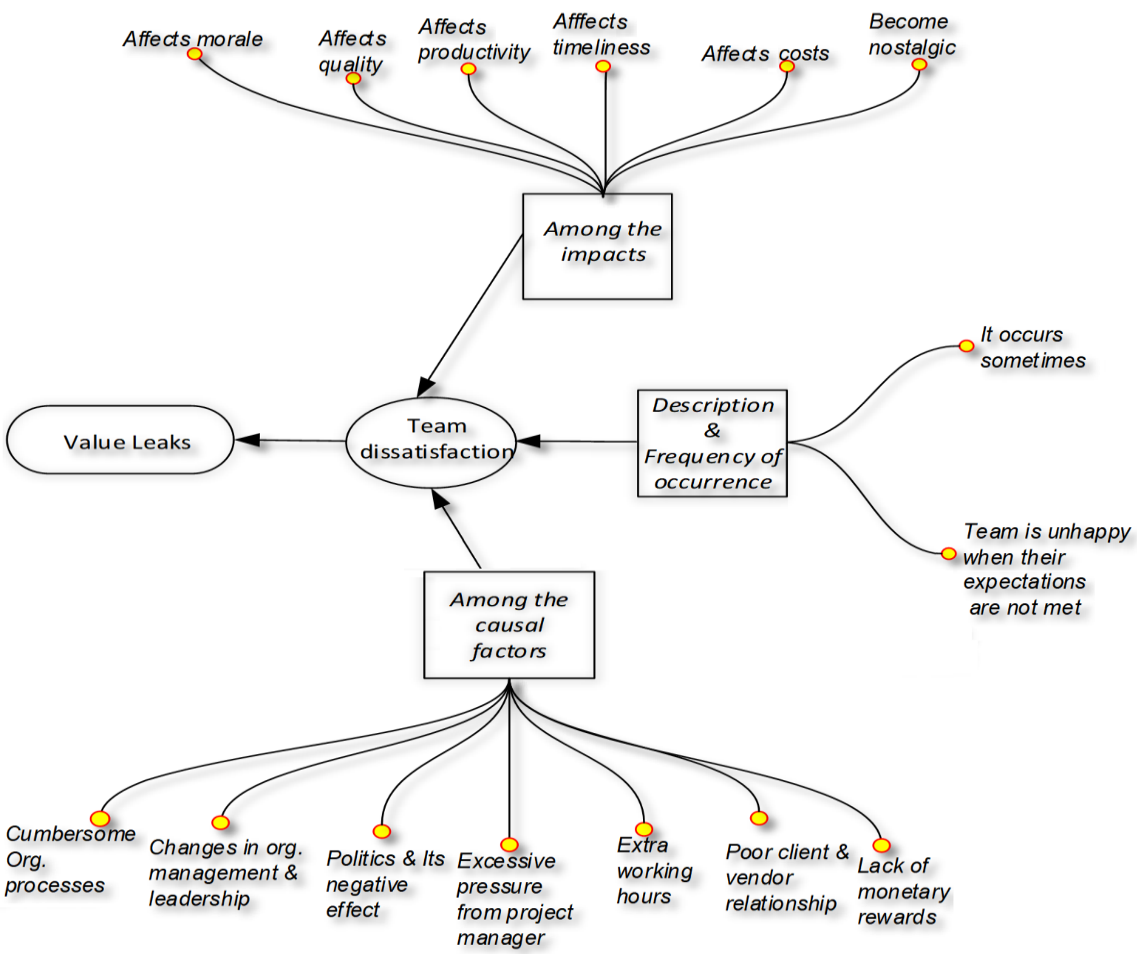


Figure 4.12: Elements derived from the narratives on team dissatisfaction

Source: Researcher's construct from field data (2019)

From Figure 4.12 above, team dissatisfaction sometimes happens during site project deployment and can affect team morale and productivity, which may result in poor quality of work, delays, and cost overrun. In Company **A**, quality and the schedule are impacted. In Company **B**, the team becomes unhappy and unproductive which affects the schedule. In Company **C**, it can cause project delays. In Company **D**, it creates conflict which has risk of affecting quality of work and delays. The findings further indicate that project team members become dissatisfied during deployment as a result of number of factors, such as working overtime, lack of earlier engagement, scope changes, conflict, politics, issues and attacks from the community. With regards to these factors, the *Model-cage for Team Dissatisfaction,* as shown in Figure 4.13, was designed to showcase the interrelation and linkages among these causal factors across the different cases.

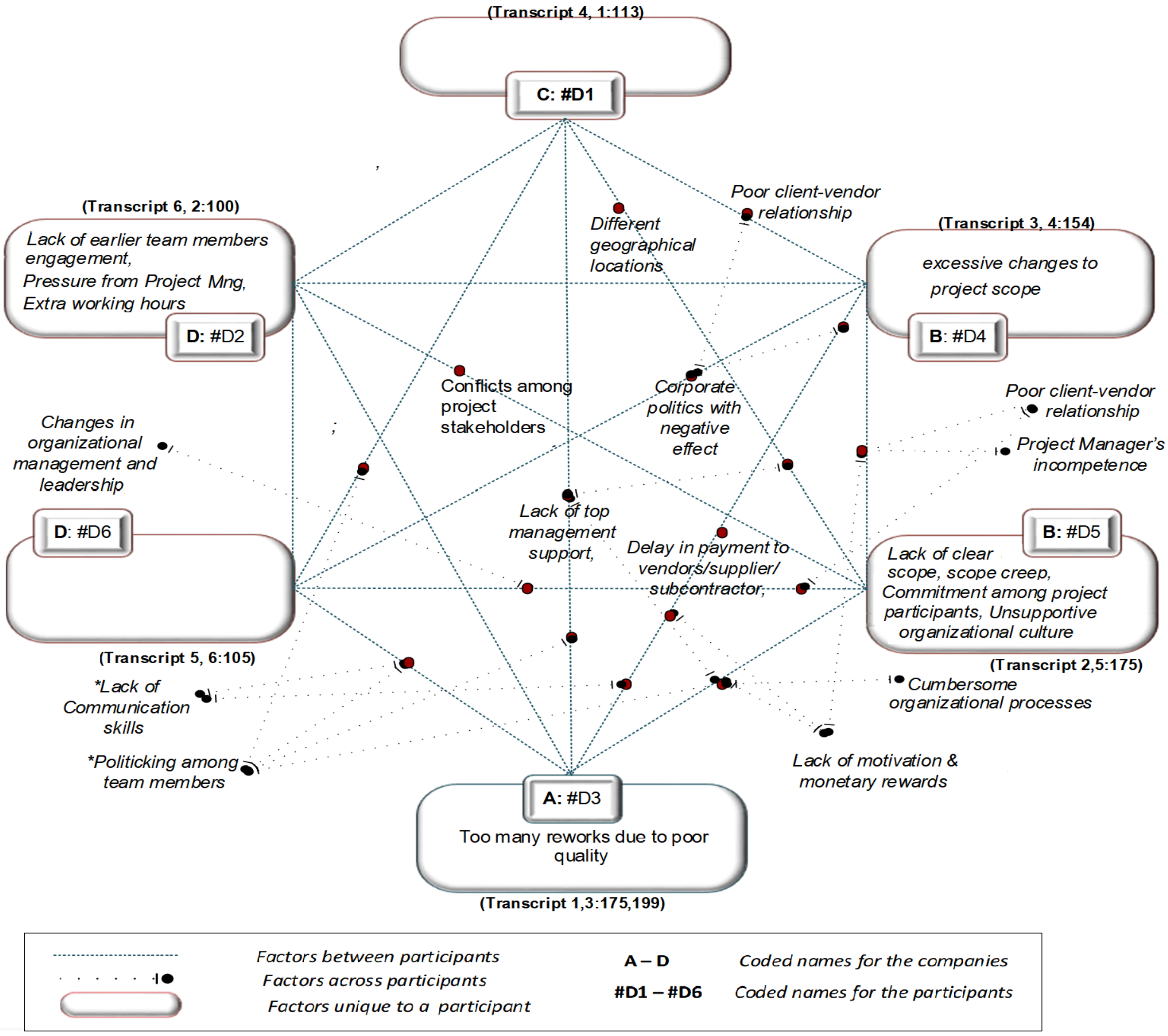


Figure 4.13: Model-cage for Team Dissatisfaction causal factors

Source: Researcher's construct from field data (2019)

From Figure 4.13, the factors exclusively identified by individual cases include: *too many reworks due to poor quality,* stated by Company **A**; *excessive changes to project scope, lack of clear scope, scope creep, commitment among project participants, unsupportive organisational culture,* outlined by Company **B**; and lack *of earlier team members engagement, unnecessary pressure from project manager, extra working hours* outlined by Company **D**. But no factor is identified uniquely by Company **C**.

The factors found to interrelate between two different cases are *changes in organisational management and leadership* found in Company **B** and **D**; *cumbersome organisational processes, delay in payment to vendors/supplier/subcontractor,* p*oor/Lack of motivation and monetary rewards* appeared in Company **A** and **B**; *different geographical locations* in Company **B** and **C**.

Additionally, the factors found in three different companies are: *poor/lack of communication skills* found in Company **A**, **B** and **D**; *lack of top management support* found in Company **A**, **B** and **C**; *poor client-vendor* relationship found in Company **B**, **C** and **D**. Lastly, the factor found in all four companies (Company A, B, C and D) is *politicking among team members* (see Figure 4.13).

4.6 SOURCES OF VALUE LEAKS' CAUSAL FACTORS

In line with Objective 3, the study sought to explore the impact of different sources of value leaks (stakeholders, project life cycle, and environment) on project performance. In achieving this objective, the participants were asked to firstly, explain what these proposed sources of value leaks are; secondly, to describe what constitutes each of these proposed sources of value leaks; thirdly, to explain how each of these proposed sources can practically be considered as a source of value leaks in cell site projects, and finally, to classify the identified value leaks' causal factors (factors that cause time overrun, cost overrun, poor quality, out of scope and team dissatisfaction) into the proposed sources of value leaks (stakeholders, project life cycle, and environment).

The findings from the interview with a list of the summarised quotes are presented in the Tables 4.5, 4.6 and 4.7 (see Appendix 4.3 for full details). The key elements derived from the narrative are also illustrated in Figure 4.7, 4.9 and 4.11.

Table 4.5: Summary of the quotes on sources of Value Leaks (Project Stakeholders)

AREAS	INTERVIEW GUIDE QUESTIONS	KEY QUOTES
PROJECT STAKE-HOLDERS	Description of project stakeholders	**#D1.** Cell site rollout stakeholders are anybody involved in the site rollout and if one team fails to perform their duty it affects the rollout **#D2**. …these are people who impact the project or impacted by the project **#D3.** Stakeholders are usually the people who are interested in the project. These stakeholders are the resources not only have interest in outcome of the project, but they are also involved in the delivery of the project **#D4.** Anyone with vested interest in the site rollout is considered a stakeholder **#D5.** These are individuals who impact, influence or are impacted by the project activities and project outcome **#D6**. These are usually external and internal stakeholders that effect the project. So usually direct impacting resources on the project and sometimes external regulatory and environmental causes can also be part of the stakeholders
	Outline site projects stakeholders from both internal and external of the company	**#D1.** As a contracting company or vendor; my external stakeholders include the customers and their third parties to the project. For instance, a customer may subcontract part of the project to another third party in addition to what we are doing. That third party is also external to my company and their actions and inactions have direct impact on the project. Internal stakeholders are my team members who play various roles **#D2.** Internal stakeholders: are the commercial team, because they would deliver the output of the project making sure that project delivers on the revenues. Other key stakeholders to be finance team to make sure payment to the vendors are done on time. Supply Chain to make sure we derive the right value from the equipment we purchase from these vendors, so they are involved in negotiating the right values at which we buy these equipment and services from the vendors. External stakeholders: the regulators especially when it comes to permitting and approval of the site; communities Opinion Leaders, who may have some interest where the site should be and how the site would impact the people in the community, towercos, vendors etc. **#D3.** From organisational functions such as supply chain, logistics and procurement, project management, network/technical engineering department, finance department, HR, and myriad of critical resources that are needed to deliver the project. The external stakeholders are from the telco, subcontractors. In some projects, the stakeholders are from the governmental or regulatory perspective. **#D4**. Internal stakeholders: project team from the requesting organisation and the implementing vendor. External to the project: Government, which is represented largely by the Regulator, the community in which you are deploying, landlord who is giving you access to land. Site rollout, being a social intervention, generally affects a larger group. So, on the implementing organisation or a requesting organisation: you look at your stakeholders in terms of the organisation itself. Its staff, the board or the investors in your organisation, the regulator or the government

AREAS	INTERVIEW GUIDE QUESTIONS	KEY QUOTES
		(because you equally need to live within the dictate of the law that governs your industry, community in which you are going to deploy, the land owners giving portion of land to deploy on. You look at all these stakeholders and find ways to manage their interest **#D5.** The internal stakeholders are basically the operations team, transmission planning team (TX), radio frequency planning team (RF) and then your external stakeholder team would be your tower companies, that you rent cell sites, regulator, the community within which you want to rollout the cell sites. These include your installers, vendors, functional heads within the cell carrier i.e. RF and TX planning heads, operation team members who after the site is rollout the sites are handed to operations team to continue its maintenance **#D6.** Practically, in my company, we have a managed service framework and the managed service team is responsible for the low-level planning once the high-level planning is done by my team. The low-level planning is completed by this external managed service partner. There is also project execution team; the project management office, there is the project sponsor that usually the management of the company (the CEO, CTO, EXECUTIVES etc.). All these are internal stakeholders. The external stakeholders to my company are sometimes are towercos i.e. the ones involved in building the towers and also getting it ready for us to deploy our equipment; the equipment vendors that providing the equipment for us to deploy; the regulatory framework i.e. EPA, and other Government Agencies, NCA that we need to get acquisition from.
	Description of project stakeholders as a source of value leaks during site project deployment	**#D1.** If a party to the project fails to perform their duties, it will impact my timeliness because cell site rollout project is interdependent. Because someone's' deliverables are your input into the project. **#D2.** For internal stakeholders, their input in delivering the project on time is quite key. For example, the supply chain function takes too long a time to negotiate on the project cost, it would cause time overrun and time overrun would lead to value leaks. If the finance team did not make payment to the vendors on time, the vendors might stall the project at some point which could delay the project which would lead to the value leaks. External stakeholders could also cause delays to the project in a sense that they can prevent work from going on in a particular site. There has been instances where people in the community have stalled rollout because of promises that were made to them about road constructions in their community because we put up a site which did not happen, so they block access to the road which prevented the subcontractors from working. So, stakeholders contribute a lot to the success of the project. **#D3.** The stakeholders contribute to for example, time delays in terms of process execution, approval sometime delays from stakeholders, decision making in itself also sometimes delay from project stakeholders. So, project stakeholders can serve as source of value leaks during rollout projects. **#D4**. So let me break this down into the various groups I have earlier identified: On the Government front which is the Regulator: imagine I applied for a permit that is supposed to take 2 weeks and then when is due date, I am told my permit has be delayed by extra 1 week due to internal issues, straight away my schedule is impacted, and I

AREAS	INTERVIEW GUIDE QUESTIONS	KEY QUOTES
		have lost revenue. For the community, due to the level of education among the people in some areas we deploy the cell sites, they raise issues which are mostly not factual but would indicate their unwillingness to allow you to undertake your rollout project. They end up impacting your schedule because you cannot ignore their claim for reason that they have an interest in the project and you must spend extra time to let them understand the objective of providing services to them. Internal stakeholders: if my project team is dissatisfied and the work they need to do in a day because of the lost morale, they deliver it in 3 days. The value I need to earn on my project has been impacted and I must find cost or increase in schedule to bring it back on **#D5.** Essentially, actions or inactions from your project team would have significant impact on your project activities and project outcome **#D6.** Project stakeholders are big factors if not well managed can cause value leaks. I think the example I made initially was where we had to do a particular project and the towercos were not properly engaged and so gave a timeliness that was not aligned in terms of the initial planning of the project. So usually, all players need to be the same table in the project planning phase.
	Value leaks causal factors from Project Stakeholders	**#D1**. Poor client and vendor relationships, lack of top management support, Inexperienced contractors, Poor communication skills, Inexperienced project team and engineers, Lack of stakeholder involvement, etc. **#D2**. Lack of earlier team members engagement, Pressure from Project Manager, Conflicts among project stakeholders, etc. **#D3**. Poor communication skills, Lack of motivation and monetary rewards, Lack of top management support, Lack of stakeholder involvement etc. **#D4**. Poor management of team motivation and motivational drivers, Poor client-vendor relationship, Excessive restriction of project budget, Inconsistent process for collecting product requirements in relation to the industry standards, etc. **#D5.** Lack of clear scope and scope creep, Lack of top management support, Lack of Communication skills, Payment of remunerations (salaries), Poor client-vendor relationship, Changes in organisational management and leadership, Quality of telecom equipment, Poor standard of workmanship, Inaccurate time and cost estimates, etc. **#D6.** Poor client-vendor relationship, Poor communication skills, Conflicts among project team, Lack of project management knowledge etc.

Table 4.6: Summary of the quotes on sources of Value Leaks (Project environment)

AREAS	INTERVIEW GUIDE QUESTIONS	KEY QUOTES
PROJECT ENVIRON-MENT	Description of cell site project environment	**#D1.** Site project environment considers the geographical location of the cell sites and the team, the alignment of regulatory bodies on the project, inflations, the current cost of living etc., have impact on project delivery. **#D2.** This could be the climate that stakeholders in a project sit. **#D3.** There is a number of environments, for example, there is Socio-Political environment. At times, the communities may have a curfew or may have some bans in place at the time of rollout which may impact the rollout. Sometimes, in the execution of projects, there may be changes in management or changes in certain key positions within the contracting telcos organisation which has some kind of impact on the project. **#D4.** With project environment, you would want to look at the physical environment, the people and the geographical concerns. A regulator is equally an environmental factor for me, so I am given a permit to go ahead and rollout because I met all regulatory requirement. I am beginning my rollout and a competitor who already has a site around, has a slip in his metrics and then there is an impact that is determined at same time. So, because of that, the regulator put a blanket ban on all operations of telcos in that locality until the regulator's team comes to reassess the impact. It impacts my cost and affects the satisfaction of my team because they are already on site to work and the work is not happening, but the family is at home. The community: if any of my team members goes out and misbehaves himself and the community is agitated and march up to site, I cannot say I am a project manager, so team go ahead with work whilst the people are mobilising and agitating. Work would stall, and you need to manage the interest of that mob until they are gone else, they may end hurting the team working and work delays further. **#D5.** Essentially, your project environment is an environment where project activities are being executed. The community, where the project team members are situated, regulatory policies, and these are generally termed as enterprise environmental factors **#D6.** I would still describe the project environment as the major external stakeholders, sometimes the financial climate of the country, exchange rates, tax policies that are set in place, the regulatory environment, the EPA, the NCA, the role they play sometimes in getting the project delivered. Also, where the site is being deployed, sometimes, there is chieftaincy issues that might come up, the residential people in the area might also be factors of the environment as well

AREAS	INTERVIEW GUIDE QUESTIONS	KEY QUOTES
	Description of cell site project environmental factors	**#D1.** Geographical location of the sites and the team, the alignment of regulatory bodies on the project, inflations, the current cost of living and its impact on project delivery. **#D2.** One of the factors could be from the external stakeholders, a regulator or an opinion leader can cause the delays in the project and this could be outside the control of the project manager and his team. Another factor that could also cause cost overrun is forex exchange which is also external to the project team **#D3.** The socio-political factors, economic factors, organisational internal factors and contracting internal organisational factors **#D4.** In addition to the regulator, the community, and the geographical location, the act of God or nature are equally issues, you could have. For instance, for by the forecast, I looked at before planning my work, I plan to cast concrete on the 14 day from start of work because looking at the weather forecast there is no expectation of rain and then by the act of God, on the 14-day morning before we get to site, it has started raining and last for the whole day. It would be uncalculated risk, for me as a project manager to tell my team to go. So, I would need postpone the casting of the concrete meaning the casting of the concrete will delay and mounting of the towers will equally delay, mounting of antennas will delay which will deliver that service will delay. **#D5.** The physical environment. You also want to look at the financial environment where you would want to know impact of your exchange rate, inflation, the legal and regulatory environment **#D6**. The financial climate of the country, exchange rates, tax policies that are set in place, the regulatory environment, the EPA, the NCA etc., that providing the equipment for us to deploy; the regulatory framework i.e. EPA, and other Government Agencies, NCA that we need to get acquisition from.
	Description of project environment as a source of value leaks during site project deployment	**#D1**. It depends on the geographical location of the cell site rollout. The cost involved in rollout site in the Southern part of the country i.e. Accra would be much less than rolling out same project in the Northern part of the country. It is a source of value leaks because cost of living, cost of transporting the equipment, inflation, etc. can impact your project budget, quality and schedule **#D2**. The impact of these environmental issues on the project is when it is caused a budget overrun, then value is unrealised and when it caused time overrun then value is also lost. So, it depends on the effect of what these causal effects in the environment create in a project. **#D3.** …the entire community banned the installation team from stepping foot on their land and the site up until today has not been delivered. So, this is a case where socio-political environment has very direct impact on the delivery. …curfews imposed by Government as a result of civil unrest, also has direct impact on the delivery where there are time delays, because the window of time to work is limited … changes in the strategies as a result of change of management has direct impact on the project **#D4**. …because the project environment equally introduces value leaks

AREAS	INTERVIEW GUIDE QUESTIONS	KEY QUOTES
		#D5. So major thing we have, and it keeps recurring is the perception that cell carriers pose health risk as much as the residents want the service, they would prevent installations based on the supposed health risk within their locations. When such instances come up, you are not able to realise that revenues you want to **#D6.** The environment plays very big role in affecting the delivery of value of the project because anytime any of these examples I made goes out or the wrong side or unpredicted, it can cause serious time and cost implications to the delivery
	Value leaks causal factors from Project Environment	**#D1**. Politics within the organisation and its negative effect, Different geographical location, Internal approval processes, Inexperienced contractors, **#D2.** Non-availability of project contractors, delays in preparing the sites by the tower companies, delay from the vendor side in importing the hardware into the country, Delay in clearing the hardware from the port, Forex exchange or exchange rate, Inflation, etc. **#D3**. Delay in payment to vendors/supplier/subcontractor, Cumbersome organisational processes, Lack of motivation and monetary rewards, Corporate politics with negative effect, lack of experience of Contractors, internal organisational processes, site permits by the communities, organisational culture, etc. **#D4**. Lack of Communication skills Project Stakeholders, Delay in payment to vendors/supplier/subcontractor, Corporate politics with negative effect, Poor client-vendor relationship, Land dispute, changes in materials cost, etc. **#D5.** Cumbersome organisational processes, Corporate politics with negative effect, Different geographical locations, Lack of Communication skills, Delay in material delivery, TX and RF plan readiness, labour dispute, Land dispute, Lack of communication skills, High inflation & interest rates, Unstable organisational environment, Fluctuation of prices of material, etc. **#D6**. Changes in organisational management and leadership, Lack of communication skills, Any form of labour disputes, etc.

Table 4.7: Summary of the quotes on sources of Value Leaks (Project life cycle)

AREAS	INTERVIEW GUIDE QUESTIONS	KEY QUOTES
PROJECT LIFE CYCLE	Outline the phases of cell site project life cycle	**#D1**. Site rollout follows the project management standards which are initiation, planning, execution (implementation and testing), handing over or closure. **#D3.** It pretty much follows the project management life cycle. It is from initiation, planning, execution (implementation and testing), handing over to closure. **#D4**. There is initiation, planning, execution and closure **#D5**. It follows typical project management life cycle; initiation, planning, execution (implementation) and closure **#D6**. We have initiation, planning, execution (implementation and testing), and closure
	Indicate the phase (s) that effect project performance the most	**#D1.** Planning, if it is not done well then, the project is likely to fail **#D3**. Planning is always very critical, if the planning phase is not done right, a lot of these value leaks issues are pre-empted before commencement of the delivery. So, I will say planning to be the most important phase **#D4**. It is the planning and execution phases, but you can slip most if your plan is not right **#D5**. The planning phase has the greatest impact on the project. If the planning is not properly done, the possibility of the project failing is high **#D6.** I would say the planning phase because usually, if you get the planning right, the execution and everything goes through and meet its value as well
	Description of project life cycle as a source of value leaks during site project deployment	**#D1**. if the activities within the stages of the project life cycle are not performed well, then some value may leak **#D3.** I will say in most cases planning is the problem and the planning with inadequate or incorrect information always poses a big problem to a loss of value. I will say that the highest risk comes from the planning phase; the second is during execution phase where the skill set of the delivering resources are critical. So, in cases where, for example the installation team or the delivery resources are not well trained. Then there are mistakes or lack of quality can also cause leaks in the value for a project **#D4**. Project life cycle is a source of value leaks because i.e. if lessons learnt from previous similar project are not incorporated into my planning, it would affect my execution phase resulting in value leaks **#D5.** If expert opinion is not sought in preparing the right budget or schedule, project is likely to fail. So, if proper planning is not done, the project objective would be realised **#D6.** Project life cycle is very important because each and every one of the components is not taken seriously or not following the right order, it would have a very big problem. If you into an execution phase without a clear

		plan, it would have a big problem. If you are executing without monitoring and evaluation as and when at each point in time on the project, you would have a big problem. So, it is really important and can bring a lot of problem to the project if you don't take it seriously.
	Value leaks causal factors from Project life cycle	**#D1.** Poor contract management, Poor scoping, Poor monitoring and control, Lack of Top Management Support, mistake and errors in design, Poor cost estimation, schedule delays, mistake and errors in design, over-specification, Lack of scope management, Lack of detailed scope, etc. **#D2.** Delay in seeking budget approval, delays in preparing the sites by the tower companies, Poor communication skills, delay from the vendor side in importing the hardware into the country, Delay in clearing the hardware from the port, Lack of earlier team members engagement, Pressure from Project Manager, Extra working hours, Scope creep , Unclear KPIs, etc. **#D3.** Inadequate resources, Inaccurate time & cost estimate, Issues of project funding, Poor scoping, Inaccurate time & cost estimate, Inadequate resources, Delay in payment to vendors/supplier/subcontractor, Too many reworks due to poor quality, Lack of detailed scope, conflicting requirement, over-specification, Poor communication skills, Lack of quality assurance and control, Scope creeping, Poor supervision, etc. **#D4.** Lack of communication skills, Too many reworks due to poor quality, Poor contract management, Poor scoping, Inaccurate time and cost estimate, Poor management of team motivation and motivational drivers, Excessive changes to project scope, Lack of Communication skills among Project Stakeholders, Delay in payment to vendors/supplier/subcontractor, Limited information, scope creeps, Inexperience of project team and engineers, Gold plating, Lack of quality assurance and control, etc. **#D5**. Lack of clear scope and scope creep, Payment of remunerations (salaries), Poor client-vendor relationship , TX and RF plan readiness, Lack of top management support, Lack of communication skills, Over-specification, Inaccurate time estimate, Site permit acquisition, etc. **#D6.** Poor communication skills, Inaccurate time estimate, Poor contract management, Late delivery of materials, Incorrect requirement, over-specification, unclear scope definition, Conflicting requirement, Poor communication skills, Lack of quality assurance and control, Scope creeping, faulty project conceptualisation, etc.

Source: Researcher's construct from field data (2019)

4.6.1 Case analysis Company A – D

Company A

Project stakeholders: the findings suggest that the people who care a lot about the outcome of the project are considered to be project stakeholders, as opined by **#D3,** the Programme Director:

> *"Stakeholders are usually the people who are interested in the project. These stakeholders are the resources not only have interest in outcome of the project, but they are also involved in the delivery of the project."*

Also, these stakeholders are found both within and externally to the company. Within the company, the functions such as supply chain, logistics and procurement, project management, network/technical engineering department, finance department, and HR, are all considered as key project stakeholders. From the external, depending on the party in question, the telecommunication companies (telcos), subcontractors, government or regulatory agencies are all seen as project stakeholders (see Tables 4.5 to 4.7 and Appendix 4.3). An enquiry into project stakeholders as a source of value leaks during site project deployment shows that the actions and inactions of the project stakeholders contribute to the occurrence of value leaks, as the Programme Director stated:

> *"The stakeholders contribute to, for example time delays in terms of process execution, approval sometime delays from stakeholders, decision making in itself also sometimes delay from project stakeholders. So, project stakeholders can serve as source of value leaks during rollout projects."*

In classifying the sources of value leaks' causal factors, the findings show that factors, such as late delivery of materials and lack of experienced contractors, are time overrun causal factors that emanate from project stakeholders. Similarly, the cost overrun causal factors associated with project stakeholders are lack of experience of contractors and requirement changes. Also, poor quality factors, such as poor communication skills, incompetence of subcontractor or contractors and conflict among project team are related to project stakeholders. Additionally, out of scope causal factors, such as poor communication skills and lack of stakeholder involvement emanate from project stakeholders. Lastly, among the identified team dissatisfaction causal factors, poor communication skills, lack of motivation and monetary rewards and lack of top management support are linked to project stakeholders (see Tables 4.5 to 4.7 and Appendix 4.3).

Project environment: in this case, the cell site project environment is found to consist of the socio-political factors, economic factors, organisational internal factors and contracting internal organisational factors. The activities from these environmental factors could impede the success of the project, as the Programme Director alluded:

> *"There is a number of environments, for example, there is Socio-Political environment. At times, the communities may have a curfew or may have some bans in place at the time of rollout which may impact the rollout. Sometimes, in the execution of projects, there may be changes in management or changes in certain key positions within the contracting telcos organisation which has some kind of impact on the project."*

In describing the project environment as a source of value leaks during site project deployment, the evidence points to the actions of the community where site project takes place, government decisions, such as the imposition of curfews, and a change in strategy resulting from a change in organisational leadership, cause the environment to have a direct impact on the delivery of the site project, as the Programme Director further illustrated:

> *"…the entire community banned the installation team from stepping foot on their land and the site up until today has not been delivered. So, this is a case where socio-political environment has very direct impact on the delivery. Curfews imposed by Government as a result of civil unrest, also has direct impact on the delivery where there are time delays, because the window of time to work is limited. Changes in the strategies as a result of change of management has direct impact on the project."*

Furthermore, the value leaks' causal factors found to have stemmed from the project environment are delays in the payment to vendors, suppliers or subcontractors, cumbersome organisational processes, lack of motivation and monetary rewards, negative effects of corporate politics, internal organisational processes, site permits by the communities, organisational culture and lack of experienced contractors. These factors cause value leaks through time overrun, cost overrun, poor quality, out of scope and team dissatisfaction (see Tables 4.5 to 4.7 and Appendix 4.3).

Project life cycle: in view of this, the finding indicates that the process of deploying a site projects follows that of the project management life cycle. Thus, from initiation, planning, execution (implementation and testing), handing over to closure. In assessing the phase that affects project performance, planning is considered as the most critical to the occurrence of value leaks, as the Programme Director explained:

> *"It pretty much follows the project management life cycle. It is from initiation, planning, execution (implementation and testing), handing over to closure. Planning is always very critical, if the planning phase is not done right, a lot of these value leaks issues are pre-empted before commencement of the delivery. So, I will say planning to be the most important phase."*

In considering project life cycle as a source of value leaks, an illustration was given that suggests that poor training to the installation team on site delivery, can result in poor quality causing value leaks, as the Programme Director exemplified:

> *"I will say that the highest risk comes from the planning phase; the second is during execution phase where the skill set of the delivering resources are critical. So, in cases where, for example the installation team or the delivery resources are not well trained. Then there are mistakes or lack of quality can also cause leaks in the value for a project."*

The value leaks' causal factors found to be linked to the project life cycle involves delay in payment to vendors/supplier/subcontractor, reworks due to poor quality, inadequate resources, inaccurate time and cost estimates, and issues of project funding. These factors cause value leaks through cost and time overruns, poor quality, out of scope and team dissatisfaction, as outlined in Tables 4.5 to 4.7 and Appendix 4.3.

Company B

Project stakeholders: in view of this case, the evidence offers that a project stakeholder is anyone with a vested interest in the site project, as **#D4** stated: "*anyone with vested interest in the site rollout is considered a stakeholder*. These stakeholders can influence the outcome of the project, as added by **#D5**: "*These are individuals who impact, influence or are impacted by the project activities and project outcome*."

In identifying site project stakeholders from both the internal and external environment, the findings indicate that stakeholders, such as a project team from the requesting organisation, staff, the board or the investors in contracting organisation, operations team, transmission planning team (TX), and radio frequency planning team (RF) are all considered as internal stakeholders. Among the stakeholders considered as external to the contracting company are the implementing vendor, government or regulator, the community where site project is deployed, landlords granting access their lands, tower companies, installers, and vendors (see Tables 4.5 to 4.7 and Appendix 4.3).

Moreover, an assessment of project stakeholders as a source of value leaks during site project deployment points to the fact that some actions of the stakeholders such as the Regulator taking longer time to grant approval, the refusal of the community to accept site deployment due to the misconception of health hazards; and landlords refusing to give out their lands for deployment, make project stakeholders a source of value leaks, as all these can impact the ability to achieve desire value, as stated by **#D5:** *"Essentially, actions or inactions from your project team would have significant impact on your project activities and project outcome"*, and further illustrated by **#D4**:

> *"So let me break this down into the various groups I have earlier identified: On the Government front which is the Regulator: imagine I applied for a permit that is supposed to take two weeks and then when is due date, I am told my permit has be delayed by extra one week due to internal issues, straight away my schedule is impacted, and I have lost revenue. For the community, due to the level of education among the people in some areas we deploy the cell sites, they raise issues which are mostly not factual but would indicate their unwillingness to allow you to undertake your rollout project. They end up impacting your schedule because you cannot ignore their claim for reason that they have an interest in the project and you must spend extra time to let them understand the objective of providing services to them. Internal stakeholders: if my project team is dissatisfied and the work they need to do in a day because of the lost morale, they deliver it in 3 days. The value I need to earn on my project has been impacted and I must find cost or increase in schedule to bring it back on."* (Project Manager)

In addition, the findings indicate that some causal factors are linked to project stakeholders as source of value leaks, which are based on aforementioned value leaks measures. In view of this, the time overrun causal factors that stem from the project stakeholders include the project manager's competency, land dispute, too many reworks due to poor quality, and issues of project funding.

Also, the project stakeholders-related cost overrun causal factors involve inaccurate time and cost estimate, lack of communication skills, and lack of project manager's competency. More so, poor quality-related causal factors include the inexperience of project team and engineers, and the quality of the telecommunication equipment.

Similarly, the out of scope-related causal factors relevant to the stakeholders entail excessive restrictions of project budget, and inconsistent processes for collecting product requirements in relation to the industry standards. Lastly, the team dissatisfaction-related causal factors to project stakeholders include poor management of team motivation and motivational drivers, and changes in organisational management and leadership, as presented in Tables 4.5 to 4.7 and Appendix 4.3.

Project environment: the evidence suggests that the project environment is where project activities are being executed, as alluded to by **#D5**: "*Essentially, your project environment is an environment where project activities are being executed.*" In this regards, the environment is found to introduce value leaks because activities from environmental factors, such as the community (where the project team members are situated to rollout), the regulator (issuance of permit to carry out site project), and the geographical location of the project teams could bring about a huge delay to the project, as further affirmed by **#D5** (see Table 4.5).

The findings also suggest that the supposed health risk associated with the site project triggers agitation and attacks by the people within the community where site deployment is taking place, which puts the lives of the project team in danger and distorts the value realisation objective, as opined by both **#D5** and **#D4:**

> *" So major thing we have, and it keeps recurring is the perception that cell carriers pose health risk as much as the residents want the service, they would prevent installations based on the supposed health risk within their locations. When such instances come up, you are not able to realise that revenues you want to."* (Network Planning Manager)
>
> *"When community is agitated and march up to site, I cannot say I am a project manager, so team go ahead with work whilst the people are mobilising and agitating. Work would stall, and you need to manage the interest of that mob until they are gone else, they may end hurting the team working and work delays further."* (Project Manager)

Additionally, the findings exhibit that the identified value leaks' causal factors related to time overrun, cost overrun and team dissatisfaction that are considered to emanate from the project environment include lack of communication skills, delay in payment to vendors/suppliers/subcontractors, negative effects of corporate politics, poor client-vendor relationship, cumbersome organisational processes, different geographical locations, land dispute, delay in material delivery, and TX and RF plan readiness, as presented in Tables 4.5 to 4.7

Project life cycle: in outlining the phases of the site project life cycle, the findings indicate that the site project follows the project management life cycle: initiation, planning, execution (implementation) and closure (see Table 4.5 and Appendix 4.3). However, project planning seems the most critical phase that affects project performance, as both **#D4** and **#D5** respectively opined:

> *"it is the planning and execution phases, but you can slip most if your plan is not right" and "the planning phase has the greatest impact on the project. If the planning is not properly done, the possibility of the project failing is high."*

Albeit, the evidence suggest that the project life cycle is considered as a source of value leaks because if project planning is poorly done, it leads to poor execution and eventually results in value leaks, as **#D5** stated*: "if proper planning is not done, the project objective would not be realised"*.

The findings also indicate that some causal factors identified from time and cost overruns, poor quality, out of scope and team dissatisfaction are linked to project life cycle as the source of origin, as presented in Table 4.5. These factors include, but are not limited to, poor management of team motivation and motivational drivers, excessive changes to project scope, lack of communication skills among project stakeholders, delay in payment to vendors/supplier/subcontractor, lack of clear scope and scope creep, and payment of remuneration (salaries) (see Tables 4.5 to 4.7 and Appendix 4.3).

Company C

Project stakeholders: the finding shows that project stakeholders refers to everyone taking part in the project, as stated by **#D1**, Project Manager: "*cell site rollout stakeholders are anybody involved in the site rollout and if one team fails to perform their duty it affects the rollout."* With the project stakeholders, project team members are considered as internal stakeholders. The customers (telcos) and third parties (subcontractors) are considered as the external stakeholders, as presented in Table 4.5 and Appendix 4.3. More importantly, the evidence suggests that project stakeholders serve as the source of value leaks because project timeliness could be impacted if a party to the project fails to perform their duties, as the Project Manager further stated:

> *"If a party to the project fails to perform their duties, it will impact my timeliness because cell site rollout project is interdependent. Because someone's' deliverables are your input into the project."*

Moreover, the factors that cause time overrun, cost overrun, poor quality, out of scope and team dissatisfaction that have been found to be linked to project stakeholders as a source of value leaks are poor client and vendor relationships, lack of top management support, inexperienced contractors, poor communication skills and an inexperienced project team and engineers (Tables 4.5 to 4.7 and Appendix 4.3).

Project environment: in line with this, the evidence illustrates that the environment for site projects considers a number of factors, such as the geographical location of the sites, alignment of regulatory bodies on the project, and inflation, as opined by the Project Manager: *"Geographical location of the sites and the team, the alignment of regulatory bodies on the project, inflations, the current cost of living and its impact on project delivery."*

The evidence further suggests that the project environment is considered to be a source of value leaks because, depending on the site location, the cost of living, cost of transporting the equipment, and inflation, could impact the project budget, quality and schedule, as explained by a Project Manager:

> *"It depends on the geographical location of the cell site rollout. The cost involved in rollout site in the Southern part of the country i.e. Accra would be much less than rolling out same project in the Northern part of the country. It is a source of value leaks because cost of living, cost of transporting the equipment, inflation, etc. can impact your project budget, quality and schedule."*

Also, among the identified value leaks' causal factors found to be associated with the project environment are: politics within the organisation and its negative effect, the different geographical locations, internal approval processes, and inexperienced contractors (see Tables 4.5 to 4.7 and Appendix 4.3).

Project life cycle: the finding related to the site project life cycle indicates that it follows the project management standards of initiation, planning, execution (implementation and testing), handing-over or closure as alluded to by the Project Manager in Table 4.5. The finding further indicates that planning is considered as the phase that impacts project performance resulting in value leaks as the Project Manager stated: *"planning, if it is not done well then, the project is likely to fail."*

In addition, the evidence shows that project life cycle becomes a source of value leaks if the activities within the phases are not done well, as alluded to by the Project

Manager: "*if the activities within the stages of the project life cycle are not performed well, then some value may leak.*" Lastly, the value leaks' causal factors found to have emanated from the project life cycle include poor contract management, poor scoping, and poor monitoring and control (see Tables 4.5 to 4.7 and Appendix 4.3).

Company D

Project stakeholders: in this case, the evidence suggests that these are people who are external or internal to the project that can affect its outcome, as stated by both **#D2**: *"…these are people who impact the project or impacted by the projec*t", and **#D6**: *"These are usually external and internal stakeholders that effect the project. So usually direct impacting resources on the project and sometimes external regulatory and environmental causes can also be part of the stakeholders*."

The findings also indicate that the project execution team, the project management office, and project sponsor (usually the management of the company, such as the CEO, CTO and executives) are all internal stakeholders.

The external stakeholders to the company are the towercos involved in building the towers, the equipment vendors, the regulatory framework, such as the EPA, and other government agencies, NCA, and the communities' opinions leaders who have an interest in where the site should be, as showcased in Table 4.5. The findings further reveal that project stakeholders contribute a lot to the success of the project but if not managed well, they can result in value leaks, as illustrated by both **#D6** and **#D2,** respectively:

> *"Project stakeholders are big factors if not well managed can cause value leaks. I think the example I made initially was where we had to do a particular project and the towercos were not properly engaged and so gave a timeliness that was not aligned in terms of the initial planning of the project. So usually, all players need to be the same table in the project planning phase."* (Head, Radio Frequency Planning & Optimisation)

> *"For internal stakeholders, their input in delivering the project on time is quite key. For example, the supply chain function takes too long a time to negotiate on the project cost, it would cause time overrun and time overrun would lead to value leaks. If the finance team did not make payment to the vendors on time, the vendors might stall the project at some point which could delay the project which would lead to the value leaks. External stakeholders could also cause delays to the project in a sense that they can prevent work from going on in a particular site. There has been instances where people in the community have stalled rollout because of promises that were made to them about road*

constructions in their community because we put up a site which did not happen, so they block access to the road which prevented the subcontractors from working. So, stakeholders contribute a lot to the success of the project." (Network Planning Director)

Lastly, the causal factors of time overrun, cost overrun, poor quality, out of scope and team dissatisfaction found to emanate from project stakeholders as sources of value leaks involves the lack of earlier team members' engagement, excessive pressure from the project manager, conflicts among project stakeholders, poor client-vendor relationships, non-availability of experience project contractors, and delays in seeking budget approval, as presented in Tables 4.5 to 4.7.

Project environment: with regards to this factor, the findings reveal that the project environment is the climate where the project sits, as opined by **#D2:** *"this could be the climate that stakeholders in a project sit."* The findings also indicate that there are certain elements of the project environment that impact the value of delivering site projects. These elements include the financial climate of the country, such as exchange rates, tax policies, the regulatory environment, namely, the Environmental Protection Agency (EPA), National Communication Authority (NCA) and the community, such as chieftaincy issues, and the residential people in the area, as stated by **#D6:**

> *"I would still describe the project environment as the major external stakeholders, sometimes the financial climate of the country, exchange rates, tax policies that are set in place, the regulatory environment, the EPA, the NCA, the role they play sometimes in getting the project delivered. Also, where the site is being deployed, sometimes, there is chieftaincy issues that might come up, the residential people in the area might also be factors of the environment as well."* (Head, Radio Frequency Planning & Optimisation)

Moreover, the findings indicate that the impact of these environmental elements could cause budget and time overruns, leading to value leaks. In view of this, the value leaks' causal factors found to originate from the project environment include delays in preparing the sites by the tower companies, delay from the vendor side in importing the hardware into the country, delay in clearing the hardware from the port, any form of labour dispute, forex exchange or exchange rate and inflation, as outlined in Tables 4.5 to 4.7 and Appendix 4.3.

Project life cycle: in outlining the phases of site project life cycle, the findings reveal that initiation, planning, execution and closure are the main phases in site project deployment (see Table 4.5 and Appendix 4.3). In addition, the evidence suggests that the planning phase has the biggest impact on project performance, as stated by **#D6**, Head, Radio Frequency Planning & Optimisation: *"I would say the planning phase because usually, if you get the planning right, the execution and everything goes through and meet its value as well."* Notably, the finding reveals that the project life cycle is essential, as the success of the project hinges on how well each phase is performed and it could bring a lot of problems to the project if not taken seriously, as Head, Radio Frequency Planning & Optimisation further opined:

> *"Project life cycle is very important because if each and every component is not taken seriously or not following the right order, it would have a very big problem. If you are into an execution phase without a clear plan, it would have a big problem. If you are executing without monitoring and evaluation as and when at each point in time on the project, you would have a big problem. So, it is really important and can bring a lot of problem to the project if you don't take it seriously."*

Also, the causal factors found to have linked to project life cycle entails lack of earlier team members' engagement, excessive pressure from project manager, extra working hours, delay in seeking budget approval, and delays in preparing the sites by the tower companies (see Tables 4.5 to 4.7 and Appendix 4.3).

4.6.2 Cross-case analysis: Sources of value leaks' causal factors

4.6.2.1 Project stakeholders

The findings across the cases on project stakeholders culminated in the design of Figure 4.14, which summarises the key elements derived from the narratives. To begin with, the inference from the various assertions made across the cases on the understanding of project stakeholders is that anyone with a vested interest has a direct bearing on the outcome of the project's activities, as illustrated in Table 4.4 and Figure 4.14.

In alluding to specific cases, in **Company A,** stakeholders are not only interested but involved in the delivery of the project similar to an assertion by **Company C.** In **Company B,** anyone with a vested interest in the site rollout is a stakeholder, whilst in **Company D,** it is a person who is impacted by the project.

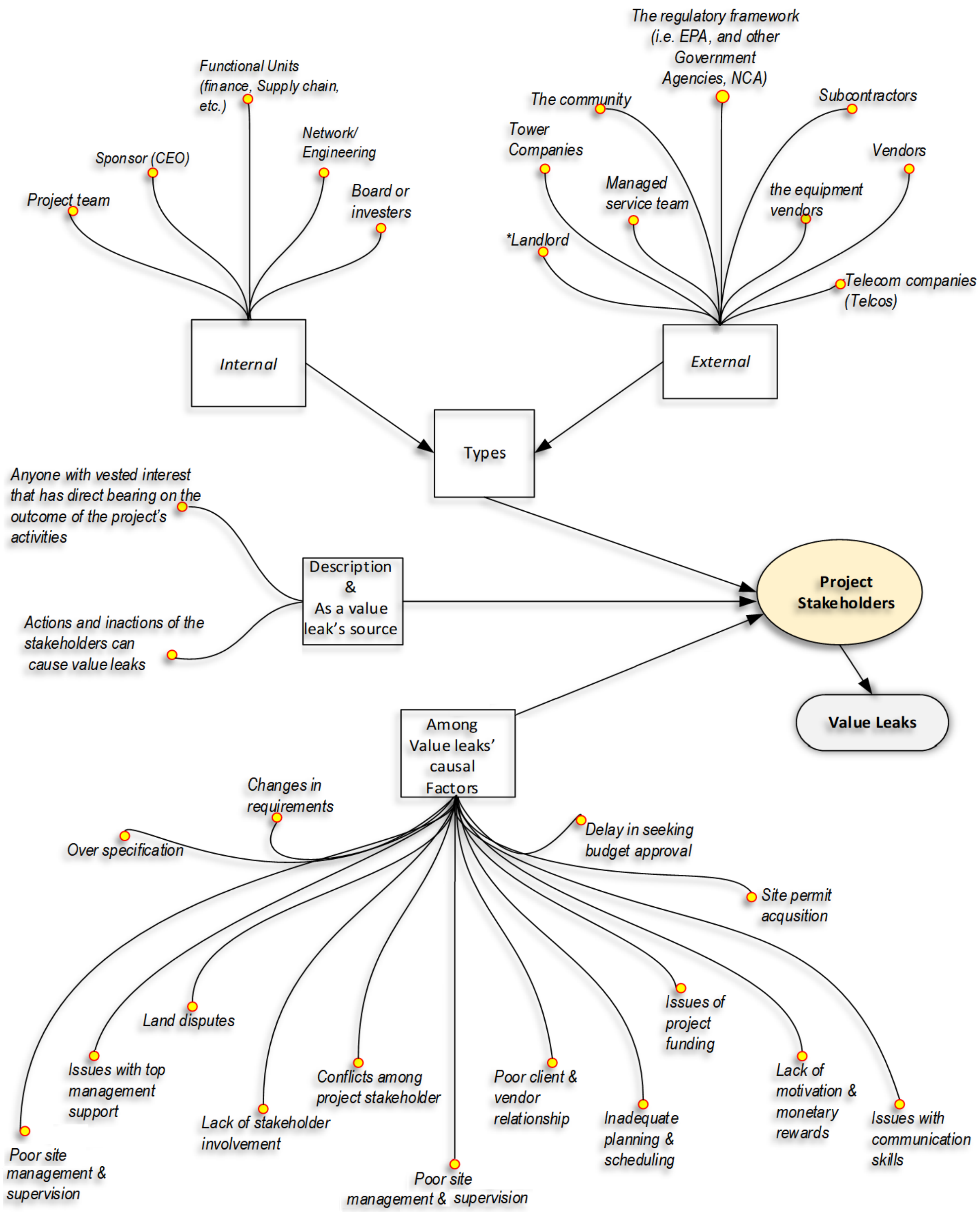


Figure 4.14: Elements derived from the narratives on project stakeholder

Source: Researcher's construct from field data (2019)

Subsequent to explaining the project stakeholders, the participants outlined list of stakeholders from both internal and external to the project. However, the cases consider themselves from different companies as external to the project, namely, telcos (operators) and vendors (contractors), but the rest of the individual stakeholders are commonly identified (see Tables 4.5 to 4.7, Appendix 4.3 and Figure 5.14).

In Company A, as a contractor or vendor to the telco; the internal stakeholders includes supply chain, logistics and procurement, and external stakeholders entail the telco, subcontractor and government.

In **Company B,** external stakeholders include contractor, government or regulator, landlords, and communities, and the internal stakeholders involve the operations team, transmission planning team (TX), and the radio frequency planning team (RF).

In **Company C,** as contracting company; telcos and their subcontractors, are external to the project but the project team is the internal to the project.

In **Company D,** the finance unit, supply chain unit, project management office and project sponsor (the CEO, CTO, EXECUTIVES) are the internal to the project but the tower companies, landlords, the regulatory framework, the EPA, and other government agencies, NCA, the equipment vendors, managed service team, installers, the community, and subcontractors are all external to the project.

More importantly, in describing project stakeholders as a source of value leaks, the deduction made from the cases' assertions is that the actions and inactions of both internal and external stakeholders could cause value leaks through the occurrence of time overrun, cost overrun, out of scope and poor quality during site project. Since these are measures of value leaks, project stakeholders can therefore be considered as a source of value leaks (see Figure 4.14).

With their accounts, in **Company A**, stakeholders' delay in approvals and decision making can culminate in a source for value leaks during rollout. In **Company B,** actions of project team have significant impact on the project outcome. In **Company C,** failure by a party to perform their duties affects the delivery of the project value, as the activities are interdependent. In **Company D,** if project stakeholders are not well managed, it can cause value leaks.

Finally, across the cases, the identified value leaks' causal factors (factors that cause time overrun, cost overrun, poor quality, out of scope and team dissatisfaction) are classified and the ones that fall under project stakeholders are outlined in Tables 4.5

to 4.7 and 4.11. The findings are further mapped based on the value leaks factors and their measures as presented in Table 4.8.

The findings, therefore, indicate that a significant number of causal factors emanate from the project stakeholders, although quite a number of these factors also originate from other sources (see Table 4.11). Delving into the findings, some causal factors interlinked across value leaks measures and others are unique to an individual value leak measure.

The causal factors interlinked across multiple value leaks measures includes, but is not limited to *poor/lack of communication skills, poor contract management, lack of project manager's competency, inaccurate time and cost estimates, conflict among project team stakeholders, and poor stakeholder management*. Interestingly, *poor communication skill* is the only factor among them that appeared in all five measures (see Table 4.6).

Conversely, the remaining factors after the exclusion of causal factors interlinked across multiple value leaks measures, are unique to each value leak measure. Thus, time overrun's unique factors involve *delay in seeking budget approval, late delivery of materials, land dispute*, whilst cost overrun's unique factors are *changes in requirement, inadequate planning and scheduling and lack of earlier team members engagement*.

Poor quality's distinct factors are *inexperience of project team and engineers and lack of stakeholder involvement;*

Out of scope has *excessive restriction of project budget* as a unique factor, and team dissatisfaction's unique factors are *excessive pressure from project manager, lack of motivation and monetary rewards, poor client-vendor relationship and payment of remunerations (salaries)*.

Table 4.8: Factors that come from project stakeholder during cell site deployment

#	VALUE LEAKS CAUSAL FACTORS FROM PROJECT STAKEHOLDERS	VALUE LEAKS MEASURES				
		TO	CO	PQ	TO	TD
1	Lack/Issues with top management support	*	*			*
2	Lack of experienced contractor	*	*	*		
3	Poor/Lack of communication skills	*	*	*	*	*
4	Poor contract management	*	*			
5	Lack of Project manager's competency	*	*			
6	Inaccurate time & cost estimates		*	*		
7	Conflict among project team stakeholders			*		*
8	Poor stakeholder management		*		*	*
9	Changes in organisational management and leadership	*				*
10	Lack of clear scope and scope creep	*				*
11	Delay in seeking budget approval	+				
12	Late delivery of materials	+				
13	Land dispute	+				
14	Too many reworks due to poor quality	+				
15	Issues with project funding	+				
16	Poor site management and supervision	+				
17	Over-specification	+				
18	Site permit acquisition	+				
19	Changes in requirement		+			
20	Inadequate planning and scheduling		+			
21	Lack of earlier team members engagement		+			
22	Inexperience of project team and engineers			+		
23	Lack of stakeholder involvement			+		
24	Excessive restriction of project budget				+	
25	Excessive pressure from project manager					+
26	lack of motivation and monetary rewards					+
27	Poor client-vendor relationship					+
28	Payment of remunerations (Salaries)					+

Notes: * = Factors across measures; + = Factors unique to each measure; TO=Time overrun; Co=Cost overrun; PQ=Poor quality; UP=Out of scope and TD=Team dissatisfaction

Source: Researcher's construct from field data (2019)

4.6.2.2 Project environment

The common comprehension of project environment across the cases can be simplified as the elements that could influence the success of the project activities at the location where it is being carried out, as demonstrated in Figure 4.15.

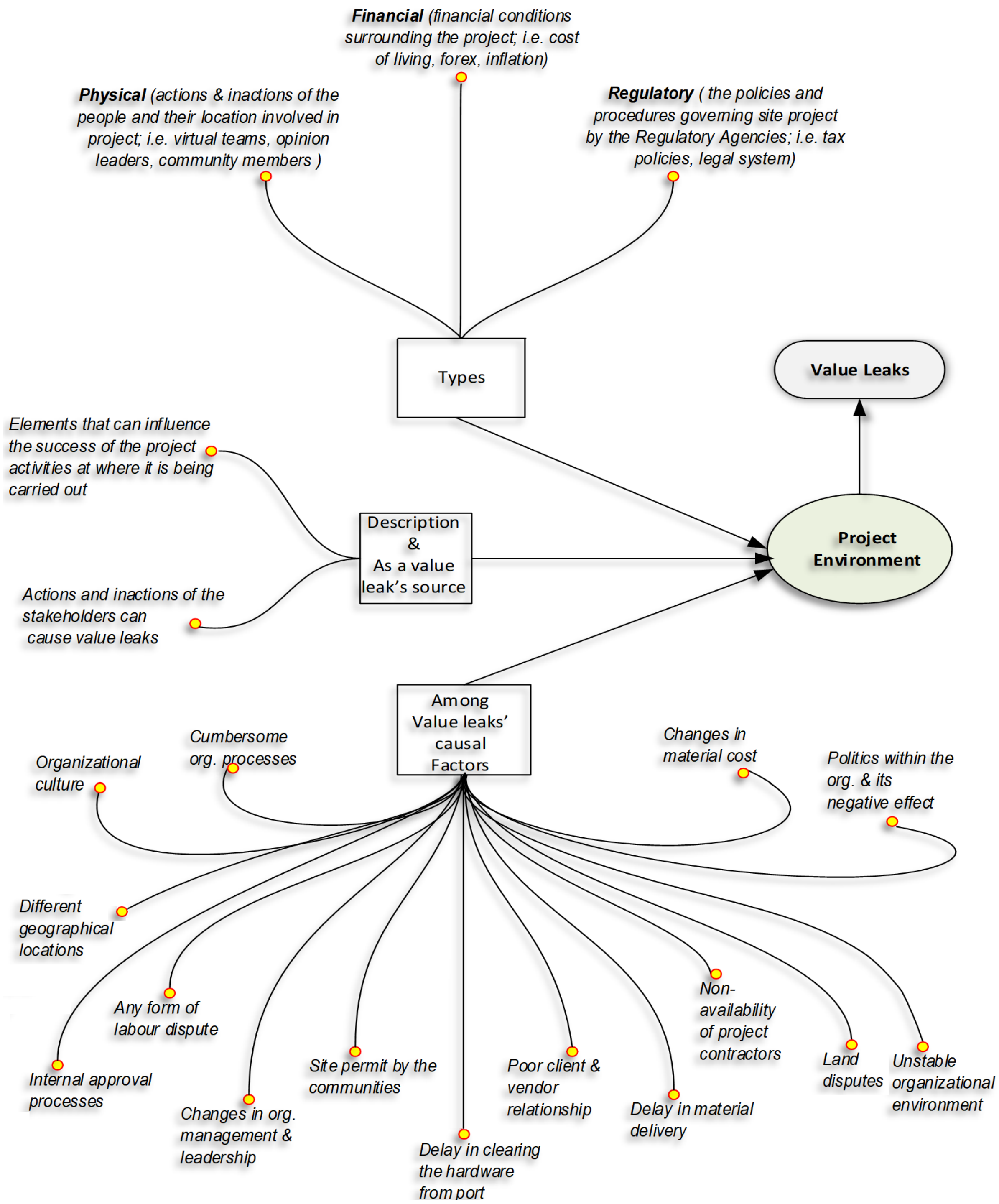


Figure 4.15: Elements derived from the narratives on project environment

Source: Researcher's construct from field data (2019)

From the findings, there are three key environments found to impact project success during deployment. Firstly, *physical environment* (social), namely, the actions and inactions of all the people and their locations involved in the project. Secondly, *financial environment* (economical*)*, namely, the financial conditions surrounding the project, and thirdly, *regulatory environment* (government), thus, the governmental and regulatory agencies' policies and procedures governing the rolling out of a site project (see Figure 4.15 and Table 4.5).

From Tables 4.5 to 4.7, **Company A** indicates that there is the socio-political environment, communities, and changes in organisational leadership. In **Company B,** the physical environment, the people and the geographical concerns, and regulatory policies. In **Company C,** the geographical location of the cell sites, the alignment of regulatory bodies on the project, inflation, and the current cost of living. In **Company D**, the financial climate of the country, exchange rates, tax policies that are set in place, the regulatory environment, the EPA, and the NCA.

The constituents of the project environment outlined across the cases could commonly be classified based on the identified three key project environments. The *physical environment* (social) includes the geographical location of the sites, the virtual teams involved, opinion leaders and their community members, the experienced contractors within the industry, organisational internal factors, contracting internal organisation factors, the weather climate, and the equipment manufacturer. The *financial environment* entails the inflation (changes in material costs), the current cost of living and its impact on project delivery, forex and exchange rates and the financial climate of the country. Lastly, the *regulatory environment* involves the legal system in the country, tax policies, National Communication Authority and Environmental Protection Agency directives and procedures (see Figure 4.15).

In citing individual cases as shown in Tables 4.5 to 4.7, in **Company A**, the socio-political factors, economic factors, organisational internal factors and contracting internal organisational factors*.* In **Company B**, the community, and the geographical location, the financial environment where you would want to know impact of your exchange rate, inflation, the legal and regulatory environment, financial climate of the country, exchange rates, and tax policies that are set in place. In **Company C,** outlined geographical location of the sites and the team, the alignment of regulatory bodies on the project, inflations, the current cost of living and its impact on project delivery*.* In

Company D, a regulator or an opinion leader can cause the delays in the project and this could be outside the control of the project manager and his team.

In line with the cases' description of project environment as a source for value leaks which is essential in achieving Objective 3, the evidence points to the fact that the actions and inactions of all the people involved in the project, the financial conditions surrounding the project and the governmental policies and procedures governing the rolling out of a site project, can cause time overruns, cost overruns, poor quality and team dissatisfaction. However, these are all measures of value leaks, hence project environment as a source of value leaks (see Figure 4.15 and Tables 4.5 to 4.7).

In reference to specific cases, in **Company A**, the socio-political environment has a very direct impact on the delivery. In **Company B,** the project environment introduces value leaks through the supposed health risks within the locations resulting from the community sabotaging installations. In **Company C,** cost of living, cost of transporting the equipment, and inflation can impact the project budget, quality and schedule. In **Company D,** the impact of environmental issues on the project can result in unrealised value (see Tables 4.5 to 4.7).

The final part of the discussion on project environment is to ascertain the identified value leaks' causal factors that are linked to the project environment across all cases. The evidence indicates that some factors are commonly found across the cases as presented in Table 4.5 and 4.9. The mapping presented in Table 4.7, shows that several causal factors originate from project environment, nevertheless, some of these factors also come from other sources (see Table 4.9). From the findings, factors such as *cumbersome organisational processes, lack of experience of contractor and poor/lack of communication skills* are observed to have intertwined with two or more value leak measures. Albeit, some factors such as *delays in preparing the sites by the tower companies, delay from the vendor side in importing the hardware into the country, delay in clearing the hardware from the port,* are unique to time overrun. Similarly, cost overrun has unique set of factors which are *forex exchange or exchange rate, changes in materials cost (inflation), internal approval processes and unstable organisational environment*. Lastly, factors such as *lack motivation and monetary rewards, poor client-vendor relationship, inexperienced contractors, different geographical locations*, and so forth, are equally unique to team dissatisfaction (see Tables 4.5 to 4.7).

Table 4.9: Factors originate from project environment

#	VALUE LEAKS CAUSAL FACTORS FROM PROJECT ENVIRONMENT	VALUE LEAKS MEASURES				
		TO	CO	PQ	UP	TD
1	Cumbersome organisational processes	*				*
2	Lack of experienced contractor	*	*			
3	Poor/Lack of communication skills		*			*
4	Delays in preparing the sites by the tower companies	+				
5	Delay from the vendor side in importing the hardware into the country	+				
6	Delay in clearing the hardware from the port	+				
7	Site permit by the communities	+				
8	Organisational culture	+				
9	Transmission (TX) and Radio Frequency plan readiness	+				
10	Land dispute	+				
11	Any form of labour dispute	+				
12	Forex exchange or exchange rate		+			
13	Changes in materials cost (Inflation)		+			
14	Internal approval processes		+			
15	Unstable organisational environment		+			
16	Politics within the organisation and its negative effect					+
17	Delay in payment to vendors/suppliers/subcontractor					+
18	Lack motivation and monetary rewards					+
19	Poor client-vendor relationship					+
20	Inexperienced contractors					+
21	Different geographical locations					+
22	Changes in organisational management and leadership					+
23	Inconsistent process for collecting product requirements in relation to the industry standards					+
24	Non-availability of project contractors					+
25	Delay in material delivery					+

Notes: * = Factors across measures; + = Factors unique to each measure; TO=Time overrun; Co=Cost overrun; PQ=Poor quality; UP=Out of scope and TD=Team dissatisfaction

Source: Researcher's construct from field data (2019)

4.6.2.3 Project life cycle

Across the cases, the general understanding construed about outlining the phases of site project life cycle is that it follows the traditional project management methodology: initiation, planning, execution (implementation and testing) and handing over or closure, as illustrated in Figure 4.16.

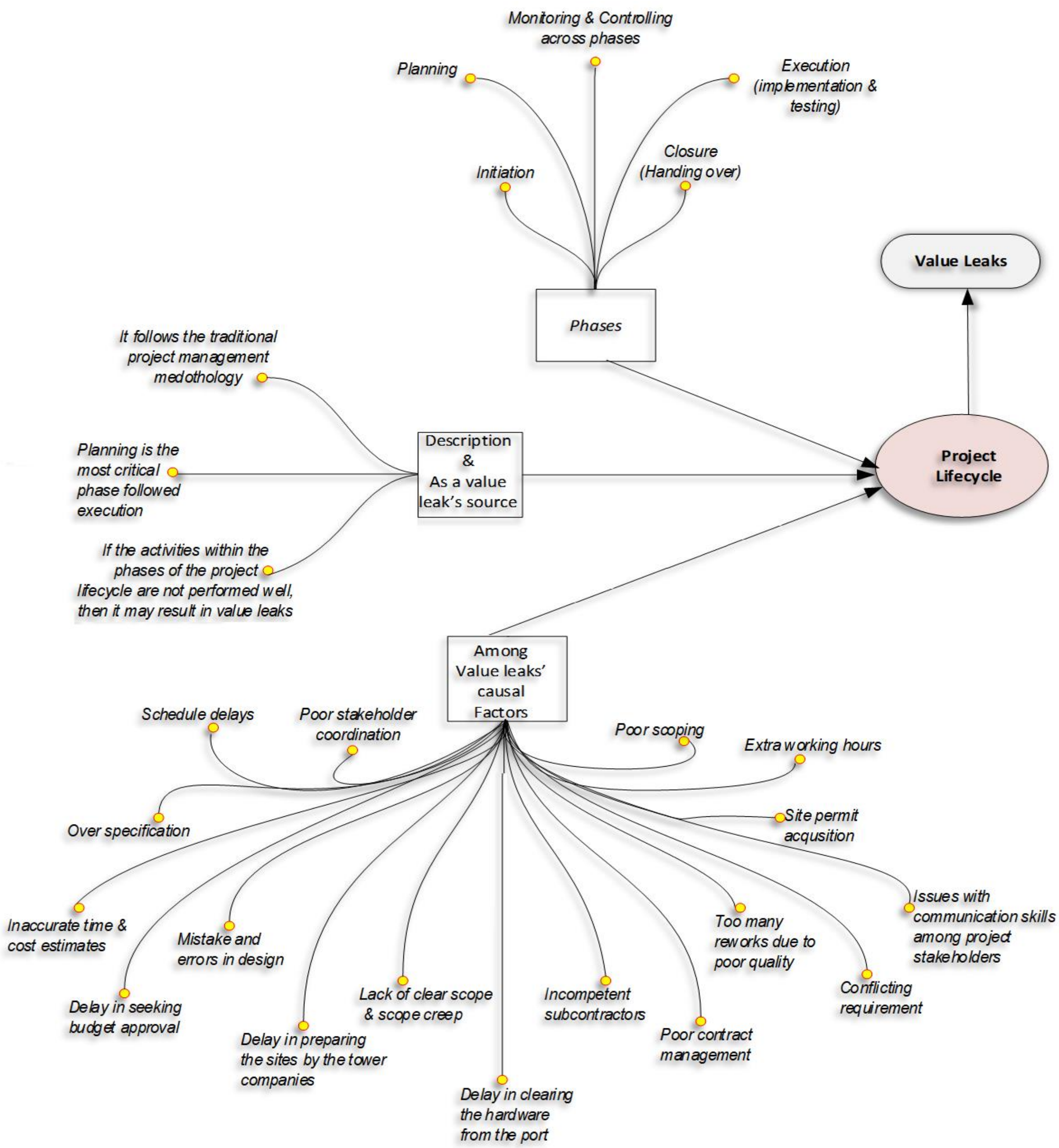


Figure 4.16: Elements derived from the narratives on project life cycle

Source: Researcher's construct from field data (2019)

In alluding to individual cases as presented in Tables 4.5 to 4.7, **Company A,** stated that it is from initiation, planning, execution (implementation and testing), handing over to closure. In the same vein, **Company B, C** and **D** commonly indicated initiation, planning, execution and closure as the phases of site project life cycle.

Also, in assessing the phase of the life cycle that affects project performance, all the cases unanimously stated the planning phase as the most critical phase in a site rollout project, followed by the execution phase, as exhibited in Figure 4.16. In view of this, in **Company A**, planning is the most important phase. In **Company B**, project slips occur most if your plan is not right. In **Company C,** if planning is not done well, the project is likely to fail. In **Company D,** if planning is done right, everything goes through and meets its value as well (see Tables 4.5 to 4.7).

Furthermore, to establish whether the project life cycle could be seen as a source of value leaks during the site project, which is the core of achieving Objective 3, the findings across the cases postulate that, indeed, the project life cycle is a source of value leaks because if the activities within the stages of the project life cycle are not performed well, it may result in value leaks (see Figure 4.16). With regards to individual case avowal, in **Company C**, value may be impacted when the activities within the stages of the project life cycle are not performed well. In **Company A,** planning with incorrect information always poses the risk of losing value. In **Company B**, when proper planning is not done, the project objective would not be realised.

The conclusion part of the project life cycle is to determine the identified value leaks' causal factors that are associated with the project life cycle. Across the cases, some factors are commonly identified, and others are uniquely outlined, as shown in Tables 4.5 to 4.7 and 4.11. The findings related to the classification are presented in Table 4.12, which suggests that the project life cycle produces the highest number of causal factors, although as mentioned earlier, some of these factors emanate from multiple sources (see Table 4.11).

The causal factors across multiple value leaks' measures include, but are not limited to: *poor/lack of communication skills, excessive restriction of project budget, lack of scope management, lack of clear scope and scope creep, too many reworks due to poor quality, and inaccurate time and cost estimates*. In contrast, causal factors such as *delay in seeking budget approval, delay in preparing the sites by the tower companies, and delay from the vendor side in importing the hardware into the country,* are unique to time overrun.

Table 4.10: Factors originating from project life cycle

#	VALUE LEAKS CAUSAL FACTORS FROM PROJECT LIFE CYCLE	VALUE LEAKS MEASURES				
		TO	CO	PQ	UP	TD
1	Poor/Lack of communication skills	*	*	*	*	*
2	Excessive restriction of project budget			*	*	
3	Lack of scope management	*		*	*	*
4	Lack of clear scope and scope creep			*	*	*
5	Too many reworks due to poor quality	*	*			
6	Inaccurate time and cost estimates	*	*			
7	Over-specification	*		*	*	
8	Changes in requirement		*			*
9	Mistakes and errors in design	*	*			
10	Limited engagement from project stakeholders		*			*
11	Inconsistent process for collecting product requirements in relation to the industry standards			*	*	
12	Conflicting requirement			*	*	
13	Poor monitoring and controlling	+				
14	Lack of top management support	+				
15	Delay in seeking budget approval	+				
16	Delay in preparing the sites by the tower companies	+				
17	Delay from the vendor side in importing the hardware into the country	+				
18	Issues with project funding	+				
19	Poor contract management	+				
20	Transmission and radio frequency plan readiness	+				
21	Site permit acquisition	+				
22	Poor scoping	+				
23	Delay in clearing the hardware from the port	+				
24	Schedule delays		+			
25	Poor stakeholder coordination		+			
26	Inadequate planning and scheduling		+			
27	Fluctuation of prices of materials		+			
28	Incompetent subcontractor		+			
29	Lack of earlier team member engagement					+
30	Excessive pressure from project manager					+
31	Extra working hours					+
32	Delay in payment to vendor/supplier/subcontractor					+
33	Poor management of team motivation and motivational drivers					+
34	Payment of remuneration (salaries)					+
35	Poor client-vendor relationship					+
36	Inadequate resources					+
37	Excessive changes to project scope				+	

Notes: * = Factors across value leaks' measures and + = Factors unique to each value leak measure

Source: Researcher's construct from field data (2019)

Also, factors such as *poor stakeholder coordination, inadequate planning and scheduling, and fluctuation of prices of materials are distinct to* cost overrun. In addition*, lack of earlier team member engagement, excessive pressure from project manager, and extra working hours,* among others, are unique to team dissatisfaction, whilst *excessive changes to project scope* is only linked to the out of scope measure (see Table 4.10).

4.6.2.4 Integrated sources of value leaks' causal factors

This section examines the causal factors that come from multiple sources, as presented in Table 4.9. The findings reveal that *poor/lack of communication skills* and *poor client-vendor relationship* are the only factors that originated from all three sources. However, apart from these two factors, no other factors were observed to have come from both project stakeholders and project environment, but all the factors from each of these sources also emanated from the project life cycle source.

Therefore, the factors which come from two different sources includes *lack of clear scope and scope creep, too many reworks due to poor quality, and issues with project funding*, as presented in Table 4.11 below.

Table 4.11: Integrated sources of value leaks' causal factors

#	VALUE LEAKS CAUSAL FACTORS	SOURCES OF VALUE LEAKS		
		Project stakeholders	Project environment	Project life cycle
		(PS)	(PE)	(PL)
1	Poor/Lack of communication skills	X	X	X
2	Lack of clear scope and scope creep	X		X
3	Too many reworks due to poor quality	X		X
4	Inconsistent process for collecting product requirements in relation to the industry standards		X	X
5	Lack/Issues with top management support	X		X
6	Delay in seeking budget approval	X		X
7	Delay from the vendor side in importing the hardware into the country		X	X
8	Issues with project funding	X		X
9	Site permit acquisition	X		X
10	Delay in clearing the hardware from the port		X	X
11	Poor client-vendor relationship	X	X	X
12	Lack of experienced contractor	X	X	

Notes: X = Factors across value leaks sources
Source: Researcher's construct from field data (2019)

4.7 SUMMARY OF THE CHAPTER

This chapter presented the findings of the case study. In a nutshell, the study interviewed six (6) senior project management practitioners through purposive sampling from four different companies within the telecommunication industry in Ghana. These individuals play a leading role either as a project manager or director with a minimum of three-and-a-half years' working experience in cell sites projects. Their level of experience and knowledge has a strong bearing on how well they answered the interview questions. From the case analysis, the findings showed that the site project provides access to telecommunication services with the purpose or value of increasing coverage, enhancing the customer experience, and so forth. It usually takes a minimum of four to six months to complete a typical greenfield site project, at a cost of about \$100K to \$250K. The EVA is found to be a common tool used for measuring project performance and reporting based on budget, time and scope in the telecommunication industry. The value of delivering cell sites is found to have been measured during the site's deployment and post implementation. The techniques used to measure value during sites deployment are the schedule (Go live date), budget (cost), quality metrics (such as availability, data speed, voice quality and clarity), scope (meeting specification), and team satisfaction. However, the value that is not realised during cell site deployment is considered as value lost or leaks. The value leak is considered when going over budget (cost overrun), schedule extends (time overrun), scope creep (out of scope), quality metrics are impacted (poor quality), and project team dissatisfaction.

The factors that cause time overrun include delays from the vendor side in importing the hardware into the country, and any form of labour disputes; cost overruns include factors such as the exchange rate, high inflation, and inaccurate cost estimates; poor quality includes limited project information, gold plating, and changing quality; out of scope includes unclear scope definition, and an inconsistent process for collecting product requirements; and team dissatisfaction includes changes in organisational management and leadership, and lack of earlier team members' engagement. These factors are found to have originated from activities related to project stakeholders, project environment and project life cycle. These findings culminated in the development of quantitative research instruments (see Appendix 5.1), which was piloted, preceding the validation and presentation, as illustrated in the next chapter.

CHAPTER 5:
QUANTITATIVE ANALYSIS AND INTERPRETATION OF FINDINGS

5.1 INTRODUCTION

This chapter presents the findings from the survey study which was performed in the qualitative phase of the study. To begin, a total of 230 questionnaires were self-administered, the data response rate analysis was conducted and further subjected to data screening and missing value imputation. Additionally, tests of multivariate analysis' assumptions were performed subsequent to demographic profiling and the analyses of key characteristics. The data was then subjected to factor analysis under four (4) main themes: firstly, the reasons for rolling out cell sites by the telecommunication players; secondly, the impact of the occurrence of value leaks during cell site rollout; thirdly, the causal factors of value leaks (measures of value leaks); and fourthly, the sources of value leaks' causal factors. Within each theme, the study performed EFA first, followed by CFA to assess the validity and reliability of Objectives 1, 2, 3 and 4 of the study.

5.2 SAMPLE DATA BREAKDOWN AND RESPONSE RATE

With a given total number of 350 employees, 187 was determined as the required sample size to achieve the objectives of the study. In order to achieve the 187 sample size required for factor analysis, the number of questionnaires was increased by 19%, taking the total number of administered questionnaires to 230, in proportion to each company's size.

This increase made provision for non-returned questionnaires and an improved response rate (Islam, 2018). Of the 230 questionnaires administered, 81% of the respondents returned the completed questionnaires, which led to the study achieving the required 187 sample size, as shown in Table 5.1. The achievement of this response rate was due to continuous engagement with the employees through their bosses, phone calls, text messages, and personal visitations. Therefore, a response of 81% does not violate the multivariate analysis assumptions for factor analysis (Bashir & Hassan, 2018).

Table 5.1: Sample data breakdown and response rate

Company	Questionnaires Administered	Questionnaires Returned	Questionnaires response rate (%)
Company A	30	28	88
Company B	40	35	77
Company C	30	20	80
Company D	35	27	93
Company E	35	28	67
Company F	20	16	80
Company G	20	15	75
Company H	20	18	90
Total	**230**	**187**	**81**

Source: Researcher's construct from field data (2020)

5.3 DATA SCREENING AND MISSING VALUE IMPUTATION

The descriptive analysis via frequency counts and percentage revealed that out of the 187 returned questionnaires, 74 of them, constituting 40%, were incomplete, as shown in Table 5.2. The respondents' refusal to complete these questionnaires might be attributed to issues of fatigue, lack of willingness to answer the questions, and lack of time to answer the questions (Garson, 2008; Field, 2005). Although, missing data has no general percentage cut-off point (Bashir & Hassan, 2018), Hair *et al.* (2010) argued that a missing value less than or equal to 10% should not pose a threat to statistical analysis. Therefore, a missing value of 40% necessitated a method for data imputation, hence, the selection of the average value imputation method which replaces the missing values with calculated means. The study used this method as it is considered to be popular and provides the researcher with the chance to analyse with complete data (Cokluk & Kayri, 2011).

Table 5.2: Summary of missing values in the returned questionnaires

Item	Frequency	Percentage
Total Questionnaires Administered	230	100
Total Questionnaires Returned	187	81
Total Incomplete Questionnaires	74	40
Total Completed Questionnaires captured in SPSS for analysis	113	60
Total Required Completed Questionnaires for Statistical Analysis	**187**	**100**

5.4 DEMOGRAPHIC PROFILE AND KEY CHARACTERISTICS

The section sought to describe the profile and key characteristics of the participants in the study. As a result, question 1 to 7 meant to examine the participants' age, gender, level of education and professional training, position and number of years work in their company, as well as the role they play in cell site rollout in the study as shown in Table 5.3:

Table 5.3: Summary of demographic profile

Demographic Factors (Variables)	Frequency	Percentage
Gender		
Male	157	84
Female	30	16
Age		
20 - 25 years	3	2
26 - 31 years	32	17
32 - 37 years	111	59
38 - 43 years	39	21
44 years and above	2	1
Education		
Certificate	1	1
Diploma	7	4
Bachelor	103	55
Masters	76	41
Professional training		
Professional training in telecommunication		
- Yes	126	70
- No	55	30
Professional training in project management		
- Yes	99	58
- No	73	42
Position		
Executive	8	4
Manager/Engineer	141	75
Unit Head	21	11
Director	17	9
Chief and beyond		
Years of service		
Less than 2 years	38	20
2-4 years	30	16

5 - 7 years	81	43
8 - 10 years	32	17
above 10 years	6	3
Role in cell site rollout		
Project team member	93	50
Project manager	17	9
Rollout Engineer	22	12
Planning & Optimisation	21	11
Project Director	34	18

Source: Researcher’s construct from field data (2020)

5.4.1 Gender and age

The study revealed that employees with direct management responsibility on cell site rollout are male dominant, constituting 84%, against their female counterparts of 16%. With regards to age bracket, the majority of the participants are 32 years and older. These participants could be considered as mature enough to provide the study with credible information to achieve the objectives of the study (see Table 5.3).

5.4.2 Level of education and professional training

The findings showed that 55% of the participants hold bachelor’s degree and 41% hold master’s degrees. In terms of professional training, 70% had training in telecommunication and 58% in project management. This meant that information was obtained from employees with excellent academic pedigrees and who have both theoretical and practical knowledge in the subject matter for the study. This, therefore, made the information that was gathered most suitable for achieving the objectives of the study (see Table 5.3).

5.4.3 Position, number of years work in the company and role play in cell site rollout

In line with the positions held by the participants, 75% are managers/engineers, 11% are Unit heads, 9% are Directors, and the majority of these participants have a minimum of 5 years’ experience with their current companies. From the perspective of role played in cell site rollout, it was evident that all the participants were the right people for the study (ranging from project managers through to project directors) as per an assertion by the PMI (2017). Therefore, in meeting the study’s objectives, the information was actually taken from well-experienced and highly influential employees per their observed rank in the telecommunication industry, who are fully involved in the cell site rollout projects as far as the project management structure is concerned (see Table 5.3).

5.5 TESTING OF MULTIVARIATE ANALYSIS' ASSUMPTIONS

Subsequent to the demographic analysis, the study performed the tests of multivariate analysis' assumptions, specifically, normality and multi-collinearity tests to access the data validity and suitability to conduct EFA, CFA and SEM, which are required to achieve the objectives of the study by first, identifying the factors that cause value leaks during project management; secondly, quantitatively examining the retained factors' contribution to the occurrence of value leaks during project management; thirdly, determining the retained factors from different sources' contributions to the occurrence of value leaks, and finally, developing a value leak diagnostic model.

According to Bryne (2010), structural equation model (SEM) analysis is well founded prior to its commencement, when the assumptions of multivariate analysis ensued. In addition, Koyuncu and Kilic (2019) concluded that tests of normality and multicollinearity should be checked first, prior to conducting EFA and CFA to be able to choose an appropriate rotation and parameter estimation method for effective interpretation and conclusion.

5.5.1 Normality test

According to Hair *et al.* (2010), data normality shows the shape of data distribution for the variables in the study. Skewness and kurtosis tests are considered as the two most widely used methods to measure data normality (Mishra & Mishra, 2019; Patel, 2015) and fall within a range of ≤ 2 and ≤5, respectively, to showcase the normal distribution of the data (Bashir & Hassan, 2018; Kim, 2013).

The test of normality findings, as presented in Table 5.4, showed that the constructs were normally distributed. Furthermore, all the items within these constructs were subjected to skewness and kurtosis tests. From the findings, all but 6 items out of 202 total items were within the skewness range of < 2, and all but 10 items were within the kurtosis range of <5. Hence, the items within the constructs were normally distributed (Bashir & Hassan, 2018) (See Appendix 5.1).

Table 5.4: Test of normality of constructs

Variables	Skewness	Kurtosis
Purpose of Sites deployment (SC)	-0.130	0.043
Impacts of value leaks (IVL)	-0.631	1.081
Cost Overrun (CO)	-0.626	-1.123
Poor Quality (PQ)	-0.372	-1.623
Time Overrun (TO)	-0.504	-1.368
Out of Scope (UP)	-0.221	-1.424
Team Dissatisfaction (TD)	-0.512	2.234
Project Stakeholder (PS)	-0.268	-0.257
Project Environment (PE)	-0.293	-0.307
Project life cycle (PL)	0.087	0.599

Source: Researcher's construct from field data (2020)

5.5.2 Multi-collinearity test

Following the normality tests of the data, multicollinearity was carried out to show the level to which a variable in a study is explained by others (Kline, 2016). The variance inflation factor (VIF), which shows the degree of variability that a variable is explained by other variables and tolerance values, which is the opposite of VIF, are the two key measures to establish multicollinearity assumption in a study (Hair *et al.*, 2010). To ensure the non-violation of establishing multicollinearity assumption, the VIF value should be < 10 and the Tolerance value should be > 0.10 (Kline, 2016; Hair *et al.*, 2010).

The findings, as presented in Table 5.5, indicate that all the VIF values were less than 10, and the Tolerance values all exceeded 0.10. Therefore, there was non-violation of multicollinearity assumptions, making the data suitable for performing EFA, CFA and structural modelling (Koyuncu & Kilic, 2019; Kline, 2016; Hair *et al.*, 2010).

Table 5.5: Multi-collinearity results indicating normality

Model	Unstandardised Coefficients		Standardised Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
(Constant)	2.472	0.495		4.996	0.000		
Purpose of Sites deployment (SC)	0.207	0.101	0.187	2.041	0.043	0.573	1.746
Impacts of value leaks (IVL)	0.159	0.099	0.139	1.604	0.11	0.645	1.551
Cost Overrun (CO)	-0.215	0.113	-0.227	-1.905	0.058	0.340	2.937
Poor Quality (PQ)	-0.027	0.149	-0.022	-0.179	0.858	0.312	3.21
Time Overrun (TO)	0.19	0.062	0.231	3.042	0.003	0.841	1.189
Out of Scope (UP)	0.001	0.143	0.001	0.006	0.995	0.316	3.169
Team Dissatisfaction (TD)	0.179	0.114	0.168	1.565	0.119	0.417	2.398
Project Stakeholder (PS)	0.179	0.135	0.176	1.329	0.186	0.275	3.642
Project Environment (PE)	-0.064	0.156	-0.061	-0.411	0.682	0.220	4.543
Project life cycle (PL)	-0.097	0.138	-0.089	-0.702	0.484	0.300	3.334

Source: Researcher's construct from field data (2020)

5.6 DESCRIPTIVE ANALYSIS OF VALUE LEAKS DIMENSIONS IN CELL SITE DEPLOYMENT

This section sought to describe the relevant dimensions of value leaks which lay the basis for achieving Objectives 1, 2, 3 and 4 of the study, subsequent to establish that the data for the study does not violate the normality and multicollinearity tests' assumptions.

5.6.1 Performance measuring criteria during cell site deployment

The intent of this section was to ascertain the criteria used in measuring the performance of deploying a cell site in the telecommunication industry. With a 5-point Likert scale (***1***= *Strongly disagree,* ***2*** = *Disagree,* ***3*** = *Neutral,* ***4*** = *Agree, and* ***5*** = *Strongly agree*), the mean scores for measuring success of deployment; on time, on cost, within quality metrics, within scope, and with satisfied project team were 4.529, 4.428, 4.465, 4.358, and 4.107, respectively (see Table 5.6).

This suggests that agreeably, all these parameters are used in the telecommunication industry as deployment measuring criteria where delivery on time, relatively has the highest consideration, and project team satisfaction has the least consideration. Also, with the same given scale and a mean score of 4.134, EVA could be considered as a technique used to measure cell site performance in the telecommunication industry.

5.6.2 Value Leaks measures in cell site deployment

The aim of this question was to identify the measures that propel an occurrence of value leaks during cell site deployment. With a 5-point Likert scale (***1***= *Strongly disagree,* ***2*** = *Disagree,* ***3*** = *Neutral,* ***4*** = *Agree, and* ***5*** = *Strongly agree*), the mean scores for value leaks when deployment is not delivered on time, within cost, quality metrics, scope, and dissatisfied project team were 4.412, 4.267, 4.262, 4.150, and 3.690 respectively.

Comparatively, not delivery cell site on time (time overrun) has the highest consideration when determining value leaks' occurrence followed by not meeting cost (cost overrun), quality metrics (poor quality) and scope (out of scope). However, project team dissatisfaction (TD) had the relatively lowest impact in determining the occurrence of value leaks during deployment (see Table 5.6).

Table 5.6: Value leaks dimensions in cell site deployment

Dimensions	Mean	Std Deviation	Min	Max
Success measures of Cell Site Deployment				
The deployment must be on Time	4.529	0.5983	2.0	5.0
The deployment must be within Cost	4.428	0.5276	3.0	5.0
The deployment must meet Quality metrics	4.465	0.5314	3.0	5.0
The deployment must be within Scope	4.358	0.5632	2.0	5.0
Project team must be satisfied during deployment	4.107	0.6634	2.0	5.0
Technique to measure Cell Site Deployment				
Earned value analysis (EVA) is a technique you use to measure site rollout performance	4.134	0.5941	2.0	5.0
Value Leaks Measures in Cell Site Deployment				
Value Leaks when deployment is not delivered on time (Time Overrun)	4.412	0.5833	2.0	5.0
Value Leaks when deployment is not delivered within cost (Cost Overrun)	4.267	0.6249	2.0	5.0
Value Leaks when deployment is not delivered within quality metrics (Poor Quality)	4.262	0.5873	2.0	5.0
Value Leaks when deployment is not delivered within scope (Unmet requirement)	4.150	0.6913	1.0	5.0
Value Leaks when project team is not dissatisfied during deployment (Team dissatisfaction)	3.690	0.6956	1.0	5.0
Frequency of value leaks occurrence				
How often does site roll-out not delivered on time?	3.134	0.5470	2.0	5.0
How often does site roll-out not delivered within cost?	2.845	0.6329	1.0	5.0
How often does site roll-out not delivered within quality metrics (call drops etc.?	2.781	0.6721	1.0	5.0
How often does site roll-out not deliver within scope?	2.695	0.7607	1.0	5.0
How often does project team become dissatisfied during deployment?	3.123	0.8366	1.0	5.0
Time overrun and Cost overrun				
Approximately how long does site roll-out delay?	2.786	1.1901	1.0	6.0
Approximately how much does site roll-out go over budget?	2.775	1.4821	1.0	5.0

Source: Researcher's construct from field data (2020)

5.6.3 Frequency of value leaks occurrence

The objective was to ascertain the frequency of value leaks' occurrence during deployment. With a 5-point Likert scale (***1***= *never,* ***2*** = *rarely,* ***3*** = *sometimes,* ***4*** = *very often, and* ***5*** = *always*), the mean scores for time overrun was 3.134, cost overrun 2.845, poor quality 2.781, out of scope 2.695, and team dissatisfaction 3.123. This proposes that time overrun, and team dissatisfaction occurs sometimes, however, cost overrun, poor quality, and out of scope rarely do occur but approximately happen sometimes during deployment. In view of this, the total duration for time overrun's occurrence had a mean score of 2.786, approximately 3 months and this falls within 2 to 4 months scale range. Also, with regards to how much does cell site deployment goes over budget, the cost overrun had a mean score of 2.775, which approximately points to $50K to $100K scale range on the questionnaire. This suggests that the occurrence of poor quality, out of scope, and project team dissatisfaction has resulting effect on project time and cost. Consequently, project is delayed by 2 to 4 months increasing the budget by $50K to $100K (see Table 5.6).

5.7 FACTOR ANALYSIS

Following the analysis of data suitability for further statistical analysis based on normality and multicollinearity tests assumptions' confirmation and having described the value leaks' relevant dimensions as the basis for achieving Objectives 1, 2, 3 and 4, this section sought to address the validity and reliability of this study.

According to Brown (2015), factor analysis is considered as the most common method used in psychometric assessment for construct validity. Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) are the two techniques used to identify the factors that best describe a construct (Koyuncu & Kilic, 2019; Kline, 2016). With this, EFA is performed first to minimise a set of variables within a given construct and further test the retained variables with CFA for assessing the validity and reliability of a study (Koyuncu & Kilic, 2019).

In this study, the findings of factor analysis were presented under four (4) main themes: firstly, the reasons for rolling out cell sites by the telecommunication players; secondly, the impacts of value leaks' occurrence during cell site rollout; thirdly, the causal factors of value leaks (measures of value leaks); and fourthly, the potential sources of value leaks' causal factors. Within each theme; the study performed EFA first, followed by CFA to assess the validity and reliability.

5.7.1 Exploratory factor analysis, EFA

EFA is adopted when the aim of the study is to determine the ideal number of factors and to ascertain whether strong correlations exist between the measured variables (Brown, 2015). In view of this, the study used the Maximum Likelihood Estimate (MLE) as a method of factor analysis, since test of normality was ensured in the study. The parallel method was used in addition to the Kaiser criterion and Scree plot methods to determine the number of factors to be kept.

The use of the parallel method helped to mitigate the issues of obtaining several factors for retention with the Kaiser criterion, and avoided the confusion of interpreting cases which show quite a lot of drops and likely cut-off points.

Sampling adequacy and data suitability for EFA was established with Kaiser-Meyer-Olkin (KMO) and Bartlett's test of sphericity. Further, Promax with Kaiser Normalisation rotation method was used to reduce the number of items with high loadings to more than one factor and retain items with factor loadings of ≥ 0.50. The reliability test of internal consistency and content validity was analysed with Cronbach alpha coefficient.

5.7.1.1 Exploratory factor analysis for the purpose of site project

This sought to explore the factors that necessitate the deployment of site projects within the telecommunication industry. In this process, extraction of the factors was done, followed by assessment of sampling adequacy and reliability before the naming of the retained factors.

Extraction of factors

The initial results from the Maximum Likelihood extraction loaded onto six (6) components based on Kaiser criterion (eigenvalues > 1), and onto seven (7) components on Scree plot observing from the point of inflexion. Nonetheless, a validation checks with parallel analysis (PA) loaded onto two (2) components (see appendix 5.2a).

In view of this, Promax with Kaiser Normalisation rotation method was performed to reduce the items as presented in Table 5.7. This result showed that the first component retained 8 items out of 26, contributing 33.529% to the variance and the second component retained 6 items attributing 9.490% to the variance. Therefore, both components contribute 43.020 % to the total variance explained, with factor loadings greater than 0.50, which is considered as practically significant (Patel, 2015).

Table 5.7: Exploratory factor analysis for purpose of cell site project

Factors Extracted	Indicators	Factor Loadings		No. of Items
		1	2	
2	SC17	0.815		
	SC09	0.809		
	SC14	0.781		
	SC13	0.758		8
	SC06	0.651		
	SC20	0.628		
	SC21	0.624		
	SC15	0.539		
	SC12		0.720	
	SC01		0.688	
	SC18		0.630	6
	SC05		0.602	
	SC03		0.505	
	SC24		0.504	
Eigenvalue		8.718	2.467	
Cronbach's Alpha		0.886	0.760	
% of Explained Variance		33.529	9.490	
Total Explained Variance				43.020
Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO)				0.891
Bartlett's Test of Sphericity	*Approx. Chi-Square*			2537.515
	Df			325
	Sig.			0.000
Goodness-of-fit Test				0.000

Source: Researcher's construct from field data (2020)

Sampling adequacy and reliability analysis

The results present sampling adequacy with Kaiser-Meyer-Olkin (KMO) of 0.891 and this result is considered as "meritorious" (Sarmento & Costa, 2019 citing Kaiser, 1958). Bartlett's test of Sphericity was also significant at (χ^2 (325) = 2537.515, $p < 0.05$). Again, the findings indicated that 8 items on component one (1) loaded very well with significant loadings of 0.539 to 0.815 and Cronbach alpha of 0.886. The other five items on component two (2) loaded quite well, with significant loadings of 0.504 to 0.720 and associated Cronbach alpha coefficient of 0.760 > 0.60 (see Table 5.7). Therefore, the findings present sampling adequacy and reliability ensuing content validity which is suitable for exploratory factor analysis (Koyuncu & Kilic, 2019; Sarmento & Costa, 2019; Patel, 2015; Hair *et al.*, 2010).

Naming and coding of the extracted items for the purpose of cell site project

In summary, a total of 14 out of 26 variables were retained for further analysis, forming two components under the purpose of cell site project. Their respective coding is presented below in Table 5.8.

Table 5.8: Synopsis of retained items under purpose of call site project

Factor naming	Codes	Item names
Factor 1 (SCF1)	SC17	Increase mobile penetration (increase customers)
	SC09	Improve voice quality and data access
	SC14	Improved user experience
	SC13	Improve data throughput
	SC06	Upgrades and enhancements/optimisations
	SC20	Keep existing subscribers on the network
	SC21	Get customers to increase their spend on the network
	SC15	Grow business
Factor 2 (SCF2)	SC12	Capacity expansions
	SC01	Increase coverage
	SC18	Drive and increase revenue
	SC05	Introduce new technologies
	SC03	Meet regulatory requirements
	SC24	Provide coverage

Source: Researcher's construct from field data (2020)

5.7.1.2 Exploratory factor analysis for the impacts of value leaks

This sought to ascertain the factors that serve as the impacts of value leaks on site deployment within the telecommunication industry as presented thereof.

- ***Extraction of factors***

The check with parallel analysis (PA) loaded onto 2 components after the initial obtained loadings onto 5 components with the Kaiser criterion and 7 on the Scree plot point of inflexion (see Appendix 5.2b). The results from Promax with Kaiser Normalisation rotation method displayed that the first component retained 7 items out of 21 contributing 30.942 % to the variance and the second component retained 5 items amounting to 9.171% of the variance. Consequently, these components contribute to total explained variance of 40.113%. The factor loadings were significantly vigorous to support the construct validity of the scales (see Table 5.9).

Table 5.9: Exploratory factor analysis for impacts of value leaks

Factors Extracted	Indicators	Factor Loadings		No. of Items
		1	2	
2	IVL10	0.843		7
	IVL15	0.727		
	IVL18	0.683		
	IVL20	0.659		
	IVL19	0.651		
	IVL14	0.588		
	IVL08	0.564		
	IVL06		0.816	5
	IVL01		0.784	
	IVL03		0.572	
	IVL09		0.527	
	IVL07		0.506	
Eigenvalue		6.498	1.926	
Cronbach's Alpha		0.847	0.785	
% of Explained Variance		30.942	9.171	
Total Explained Variance				40.113
Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO)				0.883
Bartlett's Test of Sphericity	*Approx. Chi-Square*			1579.129
	df			2100
	Sig.			0.000
Goodness-of-fit Test				0.000

Source: Researcher’s construct from field data (2020)

- ***Sampling adequacy and reliability analysis***

The findings showed Kaiser-Meyer-Olkin (KMO) of 0.883, and Bartlett’s test of Sphericity as significant at (χ^2 (2100) = 1579.129, $p < 0.05$). Also, the findings indicated that 7 items on component one (1) loaded extremely well with significant loadings of 0.564 to 0.843 with associated Cronbach alpha of 0.847. Similarly, the other 5 items on component two (2) loaded well with significant loadings of 0.506 to 0.816 resulting in Cronbach alpha coefficient of 0.785 (see Table 5.10). Hence, these findings showed sampling adequacy of the items and all the factors of impacts of value leaks have acceptable reliability with alpha value greater than the recommended threshold of ≥ 0.70 (Koyuncu & Kilic, 2019), hence content validity (Patel, 2015; Hair *et al.*, 2010).

- ***Naming and coding of the extracted items for the purpose of site project***

Under the purpose of site project, a total of 12 out of 21 variables were retained for confirmatory factor analysis after EFA—forming two components with their respective defined codes as shown in Table 5.10.

Table 5.10: Summary of retained items for impacts of value leaks

Factor naming	Codes	Item names
Factor 1 (IVLF1)	IVL10	Value leak affects telecom CAPEX budget for the year
	IVL15	Value leak impacts projections in the business case
	IVL18	Value leak can derail the project plan
	IVL20	Value leak brings about rework impacting delivery timeliness
	IVL19	Value leak increases the cost of the project
	IVL14	Value leak impacts profit rate of the supplier
	IVL08	Value leak delays customer acquisition
Factor 2 (IVLF2)	IVL06	Value leak erodes brand image
	IVL01	Value leak leads to risk of telco swapping the contracting vendor
	IVL03	Value leak leads to revenue loss
	IVL09	Value leak impacts the project objective of expanding network coverage and improving customer experience; i.e. congestions, data speed etc.
	IVL07	Value leak brings about Regulator fines

Source: Researcher's construct from field data (2020)

5.7.1.3 Exploratory factor analysis for the causal factors of value leaks

This section sought to determine the factors that cause values during project management which addresses the objectives 1 and 2. These factors are assessed under five (5) main measures: time overrun (TO); cost overrun (CO); poor quality (PQ); out of scope (UP); and team dissatisfaction (TD) as follows.

Exploratory factor analysis for time overrun dimension (TO)

The intent is to determine the initial factors that cause time overrun to occur during site deployment. In view of this, extraction of the factors, assessment of sampling adequacy and reliability as well as naming of the retained factors are presented respectively.

- **Extraction of factors**

  A validation check with parallel analysis (PA) loaded onto two components as against the initial Kaiser criterion (eigenvalues > 1) loading onto four components and Scree plot loading onto six (6) components based on the point of inflexion (see Appendix 5.2c). The findings from Promax with Kaiser Normalisation rotation method revealed that the first component retained 12 items out of 28 contributing 43.347% to the variance and the second component retained 10 items ascribing 9.655% to the variance. Both components contribute to total explained variance of

53.003 % with factor loadings greater than 0.50, which is considered as practically significant (Patel, 2015) (see Table 5.11).

Table 5.11: Exploratory factor analysis for time overrun dimension

Factors Extracted	Indicators	Factor Loadings		No. of Items
		1	2	
2	TO07	0.926		
	TO05	0.920		
	TO06	0.860		
	TO04	0.825		
	TO18	0.824		
	TO24	0.769		
	TO23	0.748		12
	TO28	0.723		
	TO16	0.697		
	TO22	0.660		
	TO26	0.579		
	TO09	0.553		
	TO25		0.957	
	TO19		0.797	
	TO17		0.766	
	TO10		0.715	
	TO11		0.706	10
	TO27		0.705	
	TO20		0.644	
	TO03		0.593	
	TO12		0.574	
	TO15		0.570	
Eigenvalue		12.137	2.703	
Cronbach's Alpha		0.943	0.908	
% of Explained Variance		43.347	9.655	
Total Explained Variance				53.003
Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO)				0.938
Bartlett's Test of Sphericity	*Approx. Chi-Square*			3596.498
	df			378
	Sig.			0.000
Goodness-of-fit Test				0.000

Source: Researcher's construct from field data (2020)

- **Sampling adequacy and reliability analysis**

The results showed sampling adequacy with Kaiser-Meyer-Olkin (KMO) of 0.938 which is considered as "marvellous" (Sarmento & Costa, 2019 citing Kaiser, 1958). Bartlett's Test of Sphericity was also significant at (χ^2 (378) = 3596.604, $p < 0.05$). In line with factor model quality (reliability analysis), the findings indicated that 12 items on components one loaded very well with significant loadings of 0.553 to 0.926 and Cronbach alpha of 0.943. Similarly, the other 10 items on component two (2) loaded quite well with significant loadings of 0.570 to 0.957 and accompanying Cronbach alpha coefficient of 0.908 (see Table 5.11). Therefore, these findings present sampling adequacy and reliability, suitable for the exploratory factor analysis (Koyuncu & Kilic, 2019; Sarmento & Costa, 2019; Patel, 2015; Hair *et al.*, 2010).

- **Naming and coding of the extracted items for time overrun dimension**

Further, to conduct EFA, a total of 22 out of 28 items (variables) were retained under time overrun to carry out a CFA. These variables form on two principal components and their associated defined codes are presented in Table 5.12.

Table 5.12: Synopsis of retained items for time overrun

Factor naming	Codes	Item names
Factor 1 (TOF1)	TO07	Late issuing of Purchase Orders (POs)
	TO05	Delay in clearing the hardware from the port
	TO06	Delays in preparing the sites by the tower companies
	TO04	Delay in seeking budget approval
	TO18	Labour dispute (within the project team and the community)
	TO24	Landlords refusal to sign a contract for leasing of the land
	TO23	Delay in material delivery since telecom equipment are not manufactured in-country but are imported
	TO28	Any form of labour disputes
	TO16	Poor planning
	TO22	Land dispute
	TO26	Site permit acquisition from the regulatory, and district assemblies
	TO09	Inaccurate time and cost estimate
Factor 2 (TOF2)	TO25	Transmission and radio frequency plan readiness
	TO19	Project manager's competency
	TO17	Too many quality shortfalls that you have to do rework
	TO10	Inadequate project resources
	TO11	Lack of experienced contractors
	TO27	Poor contract management
	TO20	Over-specification
	TO03	Poor scoping
	TO12	Issues with project funding
	TO15	Organisational cultures

Source: Researcher's construct from field data (2020)

Exploratory factor analysis for cost overrun dimension (CO)

This sought to identify the initial factors that cause cost overrun to occur during site deployment prior to confirmatory factor analysis.

- **Extraction of factors**

  The validation checks with parallel analysis (PA) showed loadings onto 2 principal components which is in contrast with the initial Kaiser criterion (eigenvalues > 1) loadings onto 4 principal components and Scree plot loadings onto 6 components based on point of inflexion (see Appendix 5.2d). Promax with Kaiser Normalisation rotation method revealed that the first principal component retained 12 items out of 21 contributing 32.939% to the variance and the second component retained 6 items amounting to 13.364% to the variance. Consequently, these components contribute to total explained variance of 46.303%. The factor loadings were significantly vigorous to support the construct validity of the scales as shown in Table 5.13.

Table 5.13: Exploratory factor analysis for cost overrun dimension

Factors Extracted	**Indicators**	**Factor Loadings**		**No. of Items**
		1	**2**	
2	CO03	0.846		12
	CO17	0.836		
	CO21	0.782		
	CO14	0.762		
	CO20	0.721		
	CO05	0.710		
	CO04	0.695		
	CO19	0.660		
	CO01	0.630		
	CO18	0.600		
	CO15	0.528		
	CO11	0.509		
	CO12		0.718	6
	CO08		0.717	
	CO07		0.675	
	CO09		0.654	
	CO10		0.572	
	CO06		0.561	
Eigenvalue		6.917	2.806	
Cronbach's Alpha		0.920	0.802	
% of Explained Variance		32.939	13.364	
Total Explained Variance				46.303
Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO)				0.900
Bartlett's Test of Sphericity	*Approx. Chi-Square*			1994.370
	df			210
	Sig.			0.000
Goodness-of-fit Test				0.000

- **Sampling adequacy and reliability analysis**

The findings showed Kaiser-Meyer-Olkin (KMO) of 0.900, and Bartlett's test of Sphericity as significant at (χ^2 (2100) = 1994.370, $p < 0.05$). Also, the findings indicated that 12 items on component one loaded extremely well with significant loadings of 0.509 to 0.846 with Cronbach alpha of 0.920. Similarly, the other 6 items on component two loaded well with significant loadings of 0.561 to 0.718 leading to Cronbach alpha coefficient of 0.802 resulting in content validity and reliability (see Table 5.14).

- **Naming and coding of the extracted items for cost overrun dimension**

In line with cost overrun dimension, a total of 18 out of 21 variables were retained forming on 2 principal components for further analysis as summarised in below Table 5.14.

Table 5.14: Synopsis of retained items for cost overrun

Factor naming	Codes	Item names
Factor 1 (COF1)	CO03	Mistakes and errors in design
	CO17	Taken insufficient information from end-users (requirement gathering)
	CO21	Project manager's competency
	CO14	Competencies of project resources (resources ability to estimate)
	CO20	Poor contract management
	CO05	Supplier is unable to commit adequate qualified resources to the project to control the impact on financial performance
	CO04	Limited engagement from project stakeholders
	CO19	Poor supervision and inspections
	CO01	Inexperienced contractors
	CO18	Unstable organisational environment
	CO15	Gold plating or over-specification
	CO11	Poor stakeholder management
Factor 2 (COF2)	CO12	Changes in materials cost (Inflation)
	CO08	Lack or poor communication skills
	CO07	Forex exchange or exchange rate
	CO09	Inadequate planning and scheduling
	CO10	Inaccurate time and cost estimate
	CO06	Issue with top management support

Source: Researcher's construct from field data (2020)

Exploratory factor analysis for poor quality dimension (PQ)

With the same procedure as previously explained, the factors that cause poor quality to occur during site deployment are explored as follow.

- **Extraction of factors**

  A validation checks with parallel analysis (PA) formed onto two principal components as against the initial Kaiser criterion (eigenvalues > 1) loadings onto four components and Scree plot loading onto seven components based on the point of inflexion (see Appendix 5.2e) and the findings are presented in Table 5.15.

Table 5.15: Exploratory factor analysis for poor quality dimension

Factors Extracted	Indicators	Factor Loadings		No. of Items
		1	2	
2	PQ08	0.878		
	PQ25	0.868		
	PQ23	0.817		
	PQ09	0.794		
	PQ06	0.765		
	PQ20	0.719		
	PQ02	0.662		
	PQ10	0.662		
	PQ11	0.633		
	PQ17	0.629		17
	PQ07	0.621		
	PQ12	0.604		
	PQ22	0.597		
	PQ14	0.581		
	PQ19	0.575		
	PQ21	0.552		
	PQ24	0.509		
	PQ13		0.815	
	PQ16		0.753	
	PQ05		0.654	5
	PQ18		0.616	
	PQ03		0.602	
Eigenvalue		9.231	2.650	
Cronbach's Alpha		0.936	0.813	
% of Explained Variance		36.924	10.601	
Total Explained Variance				47.525
Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO)				0.919
Bartlett's Test of Sphericity	*Approx. Chi-Square*			2573.527
	df			300
	Sig.			0.000
Goodness-of-fit Test				0.000

Source: Researcher’s construct from field data (2020)

From above Table 5.15, the findings from Promax with Kaiser Normalisation rotation method revealed that the first component retained 17 items out of 25, contributing 36.924% to the variance and the second component retained 5 items, contributing to 10.601% to the variance. These components altogether contribute to total explained variance of 47.525 % with factor loadings greater than 0.50, which is considered acceptable (Patel, 2015).

- **Sampling adequacy and reliability analysis**

The finding showed sampling adequacy of Kaiser-Meyer-Olkin (KMO) of 0.919, and Bartlett's test of Sphericity as significant at (χ^2 (300) = 2573.527, $p < 0.05$). In addition, the findings indicated that 17 items on component one loaded extremely well with significant loadings of 0.509 to 0.878 with associated Cronbach alpha of 0.936. The other 5 items on component two loaded well with significant loadings of 0.602 to 0.815 with Cronbach alpha coefficient of 0.813 (see Table 5.16).

- **Naming and coding of the extracted items for poor quality dimension**

Resulting from EFA for poor quality dimension, total of 22 out of 25 variables were retained for further analysis forming two principal components—these variables are coded in Table 5.16.

Table 5.16: Synopsis of retained items for poor quality dimension

Factor naming	Codes	Item names
Factor 1 (PQF2)	PQ08	Incompetence subcontractor or contractors
	PQ25	Poor project conceptualisation
	PQ23	Poor client-vendor relationship
	PQ09	Hostile socio-economic environment
	PQ06	Pressure to deliver the project
	PQ20	Unsupportive organisational culture
	PQ02	Inexperienced project team and engineers
	PQ10	Conflict among project team
	PQ11	Poor working relationship among team members
	PQ17	Poor scope alignment
	PQ07	Climate condition at the site
	PQ12	Lack of Project Manager knowledge
	PQ22	Conflicting requirement
	PQ14	Limited project information
	PQ19	Poor monitoring and control
	PQ21	Poor deliverable quality
	PQ24	Scope creeping
Factor 2 (PQF1)	PQ13	Lack of quality focus
	PQ16	Changing quality needs during project implementation
	PQ05	Unclear KPIs
	PQ18	Lack of understanding of end-user requirement
	PQ03	Lack of quality assurance and control

Source: Researcher's construct from field data (2020)

Exploratory factor analysis for out of scope dimension (UP)

This sought to explore the factors that cause out of scope to occur during site deployment. The extraction of the factors, assessment of sampling adequacy and factor model quality and naming of the retained factors are presented as follows.

- **Extraction of factors**

  The initial results from the Maximum Likelihood extraction loaded onto four (4) components based on Kaiser criterion (eigenvalues > 1), however, loaded onto seven (7) components on Scree plot from the point of inflexion. But a validation checks with parallel analysis (PA) loaded onto two (2) components (see Appendix 5.2f). Subsequently, Promax with Kaiser Normalisation rotation showed that the first component retained 7 items out of 16 contributing 38.815% to the variance and the second component retained 5 items ascribing 10.816% to the variance. These components contribute to total explained variance of 49.631% with factor loadings greater than 0.50, as shown in Table 5.17.

Table 5.17: Exploratory factor analysis for out of scope dimension

Factors Extracted	Indicators	Factor Loadings		No. of Items
		1	2	
2	UP13	0.968		
	UP16	0.931		
	UP15	0.857		
	UP08	0.818		7
	UP10	0.795		
	UP14	0.790		
	UP06	0.513		
	UP07		0.666	
	UP11		0.642	
	UP01		0.632	5
	UP02		0.544	
	UP04		0.517	
Eigenvalue		6.210	1.731	
Cronbach's Alpha		0.924	0.725	
% of Explained Variance		38.815	10.816	
Total Explained Variance				49.631
Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO)				0.911
Bartlett's Test of Sphericity	*Approx. Chi-Square*			1555.792
	df			210
	Sig.			0.000
Goodness-of-fit Test				0.000

Source: Researcher's construct from field data (2020)

- **Sampling adequacy and factor model quality analysis**

The results showed sampling adequacy with Kaiser-Meyer-Olkin (KMO) of 0.911. Bartlett's Test of Sphericity was also significant at (χ^2 (210) = 1555.792, $p < 0.05$). With factor model quality, the findings indicated that 7 items on components one loaded very well with significant loadings of 0.513 to 0.968 with Cronbach alpha of 0.924. In the same way, the other five items on component 2 loaded quite well with significant loadings of 0.517 to 0.666, with a Cronbach's alpha coefficient of 0.731 (see Table 5.17).

- **Naming and coding of the extracted items for out of scope dimension (UP)**

The table below presents the items retained after performing EFA for out of scope dimension. A total of 12 out of 16 variables forming two principal components were retained for confirmatory factor analysis as summarised in Table 5.18.

Table 5.18: Synopsis of retained items for out of scope

Factor naming	Codes	Item names
Factor 1 (UPF1)	UP13	Terrain (project environment)
	UP16	Poor standard of workmanship
	UP15	Different geographical locations
	UP08	Inconsistent process for collecting product requirements in relation to the industry standards
	UP10	Excessive restriction of project budget
	UP14	Non-availability of experienced contractor
	UP06	Over-specification
Factor 2 (UPF2)	UP07	Unclear scope requirements
	UP11	Issue with top management support
	UP01	Lack of detailed scope
	UP02	Scope creep
	UP04	Poor communication skills

Source: Researcher's construct from field data (2020)

Exploratory factor analysis for team dissatisfaction dimension (TD)

The intent is to determine the factors that cause team dissatisfaction within the telecommunication industry, in accordance with the already explained process as outlined below.

- **Extraction of factors**

  The validation checks from the parallel analysis (PA) loaded onto 3 components, however, the initial Kaiser criterion (eigenvalues > 1) loaded onto 4 components as against Scree plot loading onto 7 components based on the point of inflexion (see Appendix 5.2g). Promax with Kaiser Normalisation rotation method showed that the first component produced 6 items out of 22 contributing 9.790% to the variance, the second component retained 7 items amounting to 30.150% to the variance and lastly, the third component retained 2 items causing 12.613% to the variance. Therefore, these components contribute to total explained variance of 52.553%. The factor loadings were all significantly in support of the construct validity of the scales as indicated in Table 5.

Table 5.19: Exploratory factor analysis for team dissatisfaction dimension

Factors Extracted	Indicators	Factor Loadings			No. of Items
		1	2	3	
2	TD21	0.863			6
	TD05	0.767			
	TD06	0.751			
	TD03	0.704			
	TD13	0.692			
	TD08	0.687			
	TD16		0.823		7
	TD19		0.779		
	TD01		0.760		
	TD15		0.708		
	TD10		0.655		
	TD18		0.600		
	TD14		0.544		
	TD12			0.999	2
	TD22			0.991	
Eigenvalue		2.154	6.633	2.775	
Cronbach's Alpha		0.870	0.861	0.995	
% of Explained Variance		9.790	30.150	12.613	
Total Explained Variance					52.553
Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO)					0.848
Bartlett's Test of Sphericity	*Approx. Chi-Square*				2608.468
	df				231
	Sig.				0.000
Goodness-of-fit Test					0.000

Source: Researcher's construct from field data (2020)

- **Sampling adequacy and reliability analysis**

The findings showed sampling adequacy of the items and all the factors exceeded the acceptable Cronbach's alpha value ≥ 0.70 recommended for EFA by Koyuncu and Kilic (2019). From these findings, Kaiser-Meyer-Olkin (KMO) was 0.883, and Bartlett's test of sphericity was significant at (χ^2 (231) = 2608.468, $p < 0.05$). Also, the six items on component 1 loaded extremely well with significant loadings of 0.687 to 0.863 culminating in Cronbach alpha of 0.870. In the same vein, the 7 items on component two (2) loaded very well with significant loadings of 0.544 to 0.823 amounting to Cronbach alpha coefficient of 0.861 and lastly, 2 items loaded extremely well onto component three (3) with significant loadings of 0.991 to 0.999 leading to Cronbach alpha of 0.995 as shown in Table 5.19. This is evidence of content validity and reliability.

- ***Naming and coding of the extracted items for team dissatisfaction dimension (UP)***

A total of 15 out of 22 items forming three principal components were retained under team dissatisfaction for further analysis. Table 5.20 below shows the respective coding for the retained items.

Table 5.20: Synopsis of retained items for team dissatisfaction dimension

Factor naming	Codes	Item names
Factor 1 (TDF1)	TD21	Poor or Lack of motivation and monetary rewards
	TD05	Pressure from Project Manager
	TD06	Extra working hours
	TD03	Poor client and vendor relationships
	TD13	Project Manager's incompetence
	TD08	Delay in payment to vendors/supplier/subcontractor
Factor 2 (TDF2)	TD16	Changes in organisational management and leadership
	TD19	Cumbersome organisational processes
	TD01	Politics within the organisation and its negative effect
	TD15	Different geographical locations (working in different time zones)
	TD10	Politicking among team members
	TD18	Lack of top management support
	TD14	Commitment among project participants
Factor 3 (TDF3)	TD12	Scope creep
	TD22	Too many reworks due to poor quality

Source: Researcher's construct from field data (2020)

5.7.1.4 Exploratory factor analysis for sources of value leaks' causal factors

This section sought to explore the sources of value leaks' causal factors during project deployment which forms part of addressing Objectives 3 and 4 of the study. The findings were presented under three (3) main potential sources: project stakeholder (PS), project environment (PE), and project life cycle (PL), as follows.

Exploratory factor analysis for project stakeholder (PS)

The intent was to identify the causal factors that emanate from project stakeholders through factor extraction process and assessment of sampling adequacy and factor model quality.

- **Extraction of factors**

The initial results from the Maximum Likelihood extraction loaded onto five (5) components based on Kaiser criterion (eigenvalues > 1), however, loaded onto six (6) components on Scree plot from the point of inflexion. Nonetheless, a validation checks with parallel analysis (PA) loaded onto three (3) components (see Appendix 5.2h). Then, Promax with Kaiser Normalisation rotation showed that component 1 retained 7 items out of 28 contributing 30.334% to the variance, component 2 retained 5 items amounting 6.952% to the variance and component 3 produced 4 items causing 4.079% to the variance. Altogether, contribute to total explained variance of 41.365% with factor loadings greater than 0.50 (see Table 5.21).

Table 5.21: Exploratory factor analysis for project stakeholders

Factors Extracted	**Indicators**	**Factor Loadings**			**No. of Items**
		1	**2**	**3**	
3	PS22	0.773			
	PS16	0.751			
	PS17	0.684			
	PS08	0.681			7
	PS20	0.562			
	PS24	0.555			
	PS14	0.544			
	PS19		0.686		
	PS25		0.684		
	PS27		0.619		5
	PS15		0.593		
	PS23		0.528		
	PS26			0.711	
	PS28			0.605	4
	PS04			0.572	
	PS05			0.572	
Eigenvalue		8.494	1.946	1.142	
Cronbach's Alpha		0.843	0.805	0.741	
% of Explained Variance		30.334	6.952	4.079	
Total Explained Variance					41.365
Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO)					0.879
Bartlett's Test of Sphericity				*Approx. Chi-Square*	2276.908
				df	378
				Sig.	0.000
Goodness-of-fit Test					0.000

Source: Researcher’s construct from field data (2020)

- **Sampling adequacy and reliability analysis**

The findings showed a Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy of 0.879, indicating sufficient inter-correlations, whereas Bartlett’s test of sphericity was significant at (χ^2 (378) = 2276.908, $p < 0.05$). This is an indication that the principal components were robust making the items reliable measures of the constructs. Also, the internal consistency of the measures was assessed with Cronbach alpha and findings indicated that component 1 loaded well with significant loadings of 0.544 to 0.773 leading to Cronbach alpha of 0.843. Similarly, the other 5 items on component 2 loaded well with significant loadings of 0.528 to 0.686 contributing to Cronbach alpha coefficient of 0.805 and finally, 4 items loaded quite well onto component 3 with significant loadings of 0.572 to 0.711 resulting in Cronbach alpha of 0.741. All these alpha values exceeded that recommendation threshold of 0.70 (Koyuncu & Kilic, 2019) as shown in Table 5.21.

- **Naming and coding of the extracted items for project stakeholder (PS)**

In a nutshell, a total of 16 out of 28 variables were retained for further analysis, forming two components under project stakeholder. Their respective coding is shown in Table 5.22.

Table 5.22: Synopsis of retained items under project stakeholder

Factor naming	***Codes***	***Item names***
Factor 1 (PSF1)	PS22	Excessive restriction of project budget
	PS16	Too many reworks due to poor quality
	PS17	Issues of project funding
	PS08	Payment of remunerations (salaries)
	PS20	Inexperienced project team and engineers
	PS24	Over-specification
	PS14	Lack of Project manager's competency
Factor 2 (PSF2)	PS19	Changes in requirements
	PS25	Site permit acquisition
	PS27	Inadequate planning and scheduling
	PS15	Land dispute
	PS23	Poor site management and supervision
Factor 3 (PSF3)	PS26	Issues with top management support
	PS28	Poor stakeholder management
	PS04	Conflicts among project stakeholders
	PS05	Lack or Poor communication skills

Source: Researcher's construct from field data (2020)

Exploratory factor analysis for project environment (PE)

This sought to explore the value leaks' causal factors that originate from project environment. In line with already mentioned procedure, the findings are presented thereof.

- **Extraction of factors**

The validation checks from parallel analysis (PA) loaded onto two components, which was in contrast with the initial Kaiser criterion (eigenvalues > 1) loadings of four components and Scree plot loadings of six components based on the point of inflexion (see Appendix 5.2i). Promax with Kaiser Normalisation rotation method revealed that the first component produced 12 items out of 25 contributing 29.082% to the variance and the other component retained 11 items causing 17.739% to the variance, altogether contribute to total explained variance of 46.821%, see Table 5.23.

Table 5.23: Exploratory factor analysis for project environment

Factors Extracted	Indicators	Factor Loadings		No. of Items
		1	2	
2	PE21	0.855		12
	PE22	0.828		
	PE15	0.787		
	PE17	0.782		
	PE16	0.767		
	PE08	0.755		
	PE03	0.749		
	PE23	0.707		
	PE10	0.702		
	PE04	0.626		
	PE13	0.540		
	PE11		0.795	11
	PE09		0.747	
	PE24		0.719	
	PE01		0.705	
	PE05		0.689	
	PE12		0.648	
	PE18		0.610	
	PE20		0.562	
	PE14		0.558	
	PE25		0.543	
Eigenvalue		7.270	4.435	
Cronbach's Alpha		0.928	0.882	
% of Explained Variance		29.082	17.739	
Total Explained Variance				46.821
Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO)				0.906
Bartlett's Test of Sphericity	*Approx. Chi-Square*			2547.84
	df			300
	Sig.			0.000
Goodness-of-fit Test				0.000

Source: Researcher’s construct from field data (2020)

- **Sampling adequacy and reliability analysis**

The results produced a Kaiser-Meyer-Olkin (KMO) of 0.906 which is considered "marvellous" as asserted by Sarmento and Costa (2019) in citing Kaiser (1958). Bartlett's test of Sphericity was significant at (χ^2 (300) = 2547.84, $p < 0.05$). These findings make the study suitable and appropriate for the exploratory factor analysis (Koyuncu & Kilic, 2019; Sarmento & Costa, 2019). The findings also revealed that 11 items onto component 1 loaded well with significant loadings of 0.540 to 0.855 leading to Cronbach alpha of 0.928. Similarly, 10 items on the second component loaded well with significant loadings of 0.543 to 0.795 resulting in Cronbach alpha coefficient of 0.882. All these alpha values exceeded the recommendation threshold of 0.70 (Koyuncu & Kilic, 2019) (see Table 5.23).

- **Naming and coding of the extracted items for project environment (PE)**

Subsequent to exploratory factor analysis for project environment, a total of 21 variables forming two principal components were retained for further analysis. The labelling of these components and their respective defined codes are shown in Table 5.24

Table 5.24: Synopsis of retained items under project environment

Component naming	Codes	Item names
Factor 1 (PEF1)	PE21	Delay in material delivery
	PE22	Transmission and radio frequency plan readiness
	PE15	Delays in preparing the sites by the tower companies
	PE17	Delay in clearing the hardware from the port
	PE16	Delay from the vendor side in importing the hardware into the country
	PE08	Poor client-vendor relationship
	PE03	Delay in payment to vendors/supplier/subcontractor
	PE23	Lack of experience of contractors
	PE10	Inexperienced contractors
	PE04	Lack of motivation and monetary rewards
	PE13	Inconsistent process for collecting product requirements in relation to the industry standards
Factor 2 (PEF2)	PE11	Changes in organisational management and leadership
	PE09	Any form of labour disputes
	PE24	Changes in materials cost (Inflation)
	PE01	Politics within the organisation and its negative effect
	PE05	Cumbersome organisational processes
	PE12	Forex exchange or exchange rate
	PE18	Site permits by the communities
	PE20	Land dispute
	PE14	Non-availability of project contractors
	PE25	Unstable organisational environment

Source: Researcher's construct from field data (2020)

Exploratory factor analysis for project life cycle (PL)

This section sought to find out the value leaks' causal factors that emanate from project life cycle. In the same process as previously discussed, the factor components were first extracted followed by assessment of sampling adequacy and factor model quality as well as naming of the retained items.

- **Extraction of factors**

  The initial results from the Maximum Likelihood extraction loaded onto seven (7) components based on both Kaiser criterion (eigenvalues > 1) and Scree plot point of inflexion. On the contrary, the result from parallel analysis (PA) loaded onto five (5) components but only four (4) components retained items (see Appendix 5.2j). Subsequently, Promax with Kaiser Normalisation rotation method indicated that component 1 retained 13 items out of 37, amounting to 6.492% of the variance. Component 2 retained 7 items with variance contribution of 33.465%. Components 3 and 4 retained 4 and 2 items with variance contributions of 2.208% and 1.579% respectively. All these factors loaded above the 0.50 threshold amounting to total explained variance of 50.778%, which is also considered practically significant as argued by Patel (2015) as indicated in Table 5.25.

- **Sampling adequacy and reliability analysis**

  The Kaiser-Meyer-Olkin (KMO) result of 0.909 shows factorability of a correlation matrix indicating sampling adequacy and showed that data is suitable for exploratory factor analysis. Bartlett's test of Sphericity was also significant at (χ^2 (595) = 4285.999, $p < 0.05$). The reliability analysis of the factor model revealed that 13 items loaded onto component 1, obtained significant loadings of 0.512 to 0.863 with a Cronbach alpha of 0.928. Furthermore, 7 items loaded well onto component two with significant loadings of 0.522 to 0.816 with Cronbach alpha of 0.840.

  In addition, four items loaded on component 3 with significant loadings of 0.522 to 0.981, resulting in a Cronbach alpha of 0.816. Finally, two items loaded extremely well onto component 4, with significant loadings of 0.996 and 1.009, with Cronbach alpha coefficients of 0.996. With such high levels of Cronbach alpha coefficients, the reliability of the factor model quality was excellently achieved, as exhibited in Table 5.25.

Table 5.25: Exploratory factor analysis for project life cycle

Factors Extracted	Indicators	Factor Loadings				No. of Items
		1	2	3	4	
4	PL37	0.863				
	PL17	0.790				
	PL18	0.782				
	PL23	0.745				
	PL36	0.743				
	PL24	0.708				
	PL12	0.685				13
	PL31	0.671				
	PL35	0.663				
	PL32	0.626				
	PL15	0.622				
	PL10	0.518				
	PL25	0.512				
	PL01		0.816			
	PL33		0.813			
	PL30		0.691			
	PL21		0.674			7
	PL11		0.647			
	PL28		0.599			
	PL03		0.522			
	PL07			0.981		
	PL09			0.634		
	PL08			0.563		4
	PL06			0.522		
	PL14				1.009	2
	PL22				0.996	
Eigenvalue		2.272	11.713	2.208	1.579	
Cronbach's Alpha		0.928	0.840	0.816	0.996	
% of Explained Variance		6.492	33.465	6.309	4.512	
Total Explained Variance						50.778
Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO)						0.909
Bartlett's Test of Sphericity	*Approx. Chi-Square*					4285.999
	df					595
	Sig.					0.000
Goodness-of-fit Test						0.000

Source: Researcher's construct from field data (2020)

- **Naming and coding of the extracted items for project life cycle (PL)**

In line with project life cycle as a source of value leaks, five components were formed but the fifth one was deleted as it had no items retained. The remaining four represented Factor 1 to Factor 4 with total of 26 variables retained, as demonstrated in Table 5.26.

Table 5.26: **Synopsis of retained items under project life cycle**

Component naming	Codes	Item names
Factor 1 (PLF1)	PL37	Inconsistent process for collecting product requirements in relation to the industry standards
	PL17	Delay in payment to vendors/supplier/subcontractor
	PL18	Too many reworks due to poor quality
	PL23	Payment of remunerations (salaries)
	PL36	Excessive restriction of project budget
	PL24	Poor client-vendor relationship
	PL12	Issues of project funding
	PL31	Fluctuation of prices of material
	PL35	Conflicting requirement
	PL32	Incompetent subcontractors
	PL15	Excessive pressure from project manager
	PL10	Inadequate resources
	PL25	Over-specification
Factor 2 (PLF2)	PL01	Poor contract management
	PL33	Poor stakeholder coordination
	PL30	Inadequate planning and scheduling
	PL21	Poor or lack of communication skills among project stakeholders
	PL11	Inaccurate time and cost estimate
	PL28	Schedule delays
	PL03	Poor monitoring and control
Factor 3 (PLF3)	PL07	Delays in preparing the sites by the tower companies
	PL09	Delay in clearing the hardware from the port
	PL08	Delay from the vendor side in importing the hardware into the country
	PL06	Delay in seeking budget approval
Factor 4 (PLF4)	PL14	Lack of earlier team members engagement
	PL22	Lack of clear scope and scope creep

Source: Researcher's construct from field data (2020)

5.7.2 Confirmatory factor analysis

Orçan (2018) asserted that CFA is used to test the validity of the structure obtained after EFA. In view of this, only factor loadings greater than 0.50 were further examined with CFA to achieve Objectives 1, 2, 3 and 4 of the study.

Confirmatory measurement model was used to evaluate the validity and reliability of the variables to test and verify how well the observed variables are related to a set of latent variables. The MLE method was used to assess the consistency of the measures and the nature of the constructs. Furthermore, the variance of each scale dimension was constrained to 1.0 and modification index was fixed to 4.

Although a modification method was used to suggest model parameters that could be released to improve the model specification (Hair *et al.*, 2010), it was not too much to spoil the structure initially planned to measure (Koyuncu & Kilic, 2019).

The goodness-of-fit indices used to assess the measurement model in this study includes Absolute Fit Index, Goodness of Fit Index (GFI), Adjusted Goodness of Fit Index (AGFI), Incremental Fit Index (IFI), Tucker Lewis Index (TLI), Comparative Fit Index (CFI), Normed Fit Index (NFI), Root Mean Square Error of Approximation (RMSEA) and Root Mean Square (RMR) as summarised in Table 5.27.

The presentation of the CFA findings below is in accordance with the structure of the EFA findings already discussed.

Table 5.27: Summary of model fit indices

Fit indices Statistics	Acceptable values interpretations	References
Absolute Fit Index (χ^2/df)	≤ 5.0 or 1.0 - 4.0	Rosseni (2014), Kline (2011), Hair *et al.* (2010)
Goodness of Fit Index (GFI)	> 0.90	Hair *et al.* (2010), Hooper *et al.* (2008)
Adjusted Goodness of Fit Index (AGFI)	> 0.90	Hair *et al.* (2010), Hooper *et al.* (2008)
Incremental Fit Index (IFI)	> 0.90	Kline (2011), Hair *et al.* (2010), Marsh & Hau (1996)
Tucker Lewis Index (TLI)	> 0.90	Hair *et al.* (2010), Gaskin (2012), Hu & Bentler (1998,1999)
Comparative Fit Index (CFI)	> 0.90	Rosseni (2014), Hair *et al.* (2010), Hu & Bentler (1999)
Normed Fit Index (NFI)	> 0.90	Bryne (2011), Kline (2011), Hooper *et al.* (2008)
Root Mean Square Error of Approximation (RMSEA)	< 0.08	Rosseni (2014), Kline (2011), Hair *et al.*, (2010)
Root Mean Square (RMR)	≤ 0.050	Kline (2011), Hair *et al.* (2010), Shumacker (2010)

Source: Researcher's compilation (2020)

With regards to validity and reliability, Saunders *et al.* (2012) maintained that to ensure that a study can stand the test of time, it must focus on the validity and reliability of its research design. The study therefore adopted the most considered validity measures used in CFA as summarised in Table 5.28 and elaborated on in the subsequent presentations.

Table 5.28: Summary of validity and reliability analysis

Measures	Statistical Techniques and Cut-off Points	References
Measures of Validity		
Content Validity	Inter-item correlations with coefficient values less than 0.90 Cronbach's alpha greater than 0.60	Herman (2010) Patel (2015), Hair *et al.* (2010)
Construct Validity	Factor loadings should be ≥ 0.50 to exhibit factorability of the items on the construct	Hair *et al.* (2010)
Convergent Validity	AVE estimates should be ≥ 0.50 or AVE estimates little below 0.50 but have square root of AVE, (composite reliability, CR) estimates ≥ 0.60 should be considered as exhibiting convergent validity.	Hair *et al.* (2010), Kline (1998), Fornell & Larcker (1981)
Discriminant Validity	Square root of AVE, (composite reliability, CR) estimates should be more than the correlation coefficient values or When correlation coefficient values are < 0.70	Hair *et al.* (2010), Fornell & Larcker, 1981).
Criterion Validity	Concurrent validity whereby the correlation coefficients should be significant at $p < 0.01$ level which predicts the outcomes.	Wong (2002)
Unidimensionality	overall model fit standardised parameter estimates of the initial measurement model should all be significant ($p<0.05$)	Lopez *et al.* (2006) Ya'acob (2008)
Measures of Reliability		
Internal consistency	Cronbach's alpha greater than 0.60 shows strong correlation between the measurement variables	Patel (2015), Saunders *et al.* (2009).

Source: Researcher's compilation (2020)

5.7.2.1 Measurement Model: The purpose of cell site project

The purpose of undertaking cell sites project in the telecommunication industry lay the foundation for achieving all the objectives. After EFA, a total of 14 variables forming a two-factor correlated model were subjected to first and second-order confirmatory factor analysis. The findings are presented on the goodness-of-fit indices for the measurement model (see Table 5.29) and the standardised solution of the measurement model (see Figure 5.1).

Table 5.29: CFA fit indices: Purpose of cell sites

Goodness of Fit Measures	**X^2 /df**	**p-value**	**RMR**	**GFI**	**AGFI**	**NFI**	**IFI**	**TLI**	**CFI**	**RMSEA**
Recommended Value	≤ 5.0	> 0.05	≤ 0.05	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90	< 0.08
Measurement Model	1.877	0.059	0.026	0.973	0.929	0.954	0.978	0.958	0.977	0.069
Notes: X^2 = 15.012; df = 8; LO=0.000 & H=0.122; **PCLOSE >** 0.000 **=** 0.245										

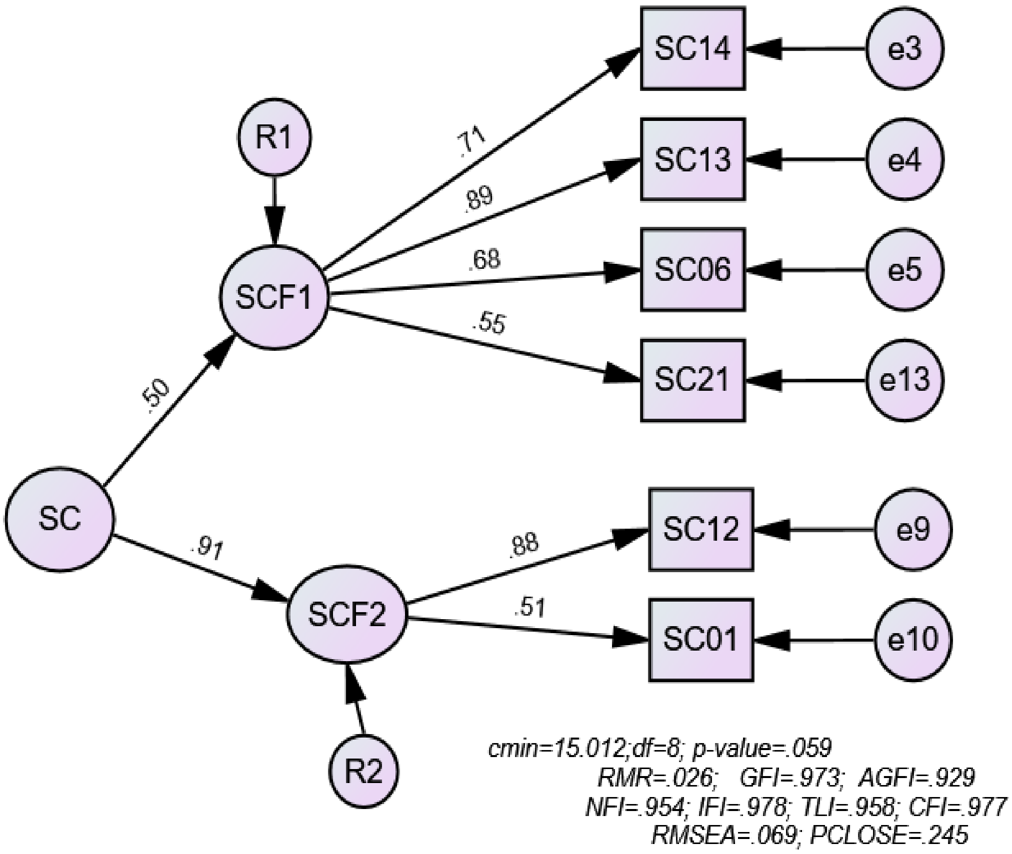


Figure 5.1: Standardised solution of the measurement model: Purpose of cell sites

The goodness-of-fit indices of the final measurement model showed evidence of adequate good fit of the data, hence, unidimensional validity is ensured. Lopez *et al.* (2006:226) asserted that achieving an overall model fit for data constitutes the unidimensionality of the scale usage. In line with this, the chi-square statistics (X^2/df) = 1.877 was within the acceptable value of ≤ 5.0, and its associated p-value was non-significant at 0.059 ($p > 0.05$), showing overall model fit (Asoka, 2015; Rosseni, 2014; Kline, 2011; Hair *et al.*, 2010).

Also, the Root Mean Squared Residual (RMR) value of 0.026 fell within the pre-defined value of 0.050 which is the square root of the mean of the residuals between the observed variables and the estimated metrics. Both the Goodness-of-Fit Index (GFI) = 0.973 and Adjusted Goodness-of-Fit Index (AGFI) = 0.929 values exceeded the recommended value of 0.90, indicating how well the model fit a set of observations (Hair *et al.*, 2010; Hooper *et al.*, 2008).

All the comparative indices (Normed Fit Index (NFI) = 0.954, Incremental Fit Index (IFI) = 0.978, Tucker Lewis Index (TLI) = 0.958 and Comparative Fit Index =0.977) exceeded the recommended value of > 0.90, providing evidence of the absolute fit of the specified model in comparison with the absolute fit of an independent model (Rosseni, 2014; Gaskin, 2012; Hair *et al.*, 2010; Hu & Bentler, 1999, 1998).

The results further revealed that the Root Mean Square Error of Approximation (RMSEA) value of 0.069 fell within the acceptable value of > 0.08, indicating how the model fit the population covariance matrix (Rosseni, 2014; Kline, 2011; Bryne, 2010; Hair *et al.*, 2010).

In line with attaining the final model fit, 4 out of 8 observed variables in Factor 1 (SC17, SC09, SC20 & SC15) were deleted. Similarly, 4 out of 6 observed variables (SC18, SC05, SC03 & SC24) were dropped. This deletion was necessitated through the observation of the low factor loadings, non-significant factor contribution, extreme standardised residual values and path estimates. The smaller number of variables retained conform to the Item Response Theory (IRT) which states that the fewer the items, the better the measures provided (Bongomin, 2016:152).

In addition, the results from Promax with Kaiser Normalisation rotation method showed that all items had factor loadings from 0.506 to 0.888, > 0.50 acceptable value (see Figure 5.1 and Table 5.30). This supports the factorability of the items, hence, construct validity was appropriately determined (Hair *et al.*, 2010). Koyuncu and Kilic (2019) summarised construct validity as the degree to which a construct is measured by a scale, and factor loadings should be ≥ 0.50 to exhibit factorability of the items on the construct (Hair *et al.*, 2010). Also, the findings indicated that the standardised parameter estimates of the initial measurement model were all significant ($p<0.000$) and the critical ratios exceeded the acceptable threshold ≥ 2.00, further supporting the unidimensionality of the construct (Ya'acob, 2008:235) (see Appendix 5.3a).

Furthermore, the findings showed average variance extracted estimates (AVE) of 0.516 and 0.512 with respect to Factors 1 and 2, exceeding the recommended value of 0.50, hence, the observed variables converged well on the constructs (Hair *et al.*, 2010; Fornell & Larcker, 1981). Convergent validity is explained as the level to which a set of observed variables converge on a construct, and it is assessed through an average variance extracted estimates (AVE) (Hair *et al.*, 2010).

Similarly, the discriminant validity is well recognised, and it is explained as the degree to which one construct or latent variable is distinct and unique from other latent variables or constructs within a model (Hair *et al.*, 2010). With this, the square root of AVE (composite reliability, CR) estimates should be more than the correlation coefficient values, or the correlation coefficient values should be < 0.70 (Hair *et al.*, 2010, Fornell & Larcker, 1981).

The findings showed CR values of F1=0.718 and F2=0.715, where both are first less than 0.70 threshold, and greater than its correlation coefficient =0.453, hence, the discriminant validity was well recognised. In addition, the correlation coefficient values of F1 <-->F2= 0.453** are significant at $p <0.01$, indicating criterion validity, a level which predicts the outcomes (Wong, 2002). Koyuncu and Kilic (2019, in quoting Cureton, 1951) asserted that criterion validity shows whether a test measures what it is planned to measure, as shown in Table 5.30.

In order to establish the latent variables' (Factor 1 & 2) contribution to the global latent variable (impact of value leaks), a second-order measurement model was performed. Therefore, the findings from standardised regression weights for the default model also showed the latent variables' (First-order Latent Variables) contributions to the global latent variables (Second-order Latent Variable) (see Table 5.30). The findings revealed that Factor 1 (SCF1) constitutes 50% and Factor 2 (SCF2) constitutes 91% as the reasons for undertaking cell site projects (SC).

Table 5.30: Standardised Regression Weights: (Group number 1-Default model)

Factor	Codes	Item Names	Estimates	AVE	CR
Factor 1	SC14	Improved user experience	0.714	0.516	0.718
	SC13	Improve data throughput	0.888		
	SC06	Upgrades and enhancements/optimisations	0.679		
	SC21	Get customers to increase their spend on the network	0.552		
Factor 2	SC12	Capacity expansions	0.876	0.512	0.715
	SC01	Increase coverage	0.506		
Second-order Latent Variable		First-order Latent Variables	Standardised Factor Loading	Correlation Estimate	
Purpose of Sites rollout (SC)		Factor I	0.496	0.453**	
		Factor 2	0.913		

Notes: AVE: Average Variance Extracted = **(**Summation of squared factor loading) / (summation of squared factor loading) + (summation of error variances); CR: Composite Reliability = (Square Root of AVE) (Fornell & Larcker (1981); **p<0.01; F1<-->F2 = correlation coefficients between the factors.

5.7.2.2 Measurement Model: Project success criteria

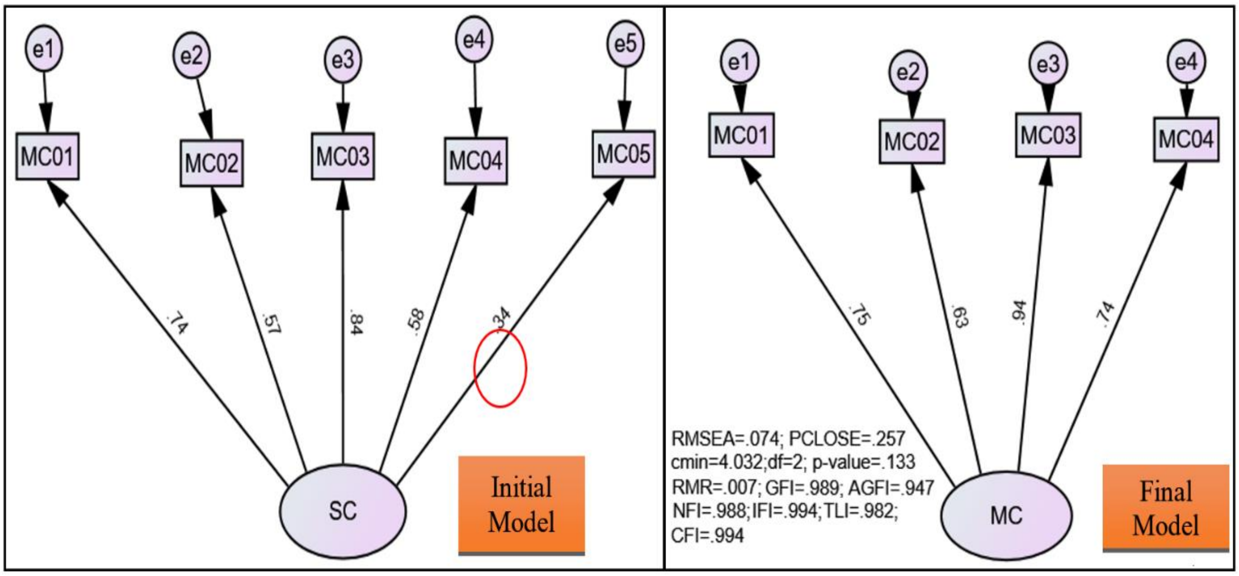
This sought to confirm the criteria used in measuring project success in the telecommunication industry after the descriptive analysis, which is also served as the dependent variable for the structural modelling testing. The findings would enhance the achievement of Objectives 3 and 4, leading to perfect conclusions for the study.

The findings from the initial measurement model showed that all the standardised parameter estimates were significant at p=0.000 and all critical ratios exceeded ≥ 2.00, which supports unidimensionality of the construct (Ya'acob, 2008; Lopez *et al.*, 2006) (see Appendix 5.3a). Also, the findings from the initial measurement model showed that all the factor loadings exceeded the recommended threshold of > 0.50 (Hair *et al.*, 2010) except MC05. Thus; MC01=0.739, MC02=567, MC03=835, MC04=582 and MC05 =338 (see Figure 5.2).

This confirms the finding from the descriptive analysis that project team satisfaction (MC05) is not a criterion in measuring project success in the telecommunication industry. In determining a goodness-of-fit model for project success criteria, MC05 was deleted, and without any enhancement through modification, the final model fit was achieved, as presented in Table 5.31 and 5.33.

Table 5.31: CFA fit indices: Project success criteria

Goodness of Fit Measures	X^2 /df	p-value	RMR	GFI	AGFI	NFI	IFI	TLI	CFI	RMSEA
Recommended Value	≤ 5.0	> 0.05	≤ 0.05	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90	< 0.08
Measurement Model	2.016	0.133	0.007	0.989	0.947	0.988	0.994	0.982	0.994	0.074
Notes: X^2 = 4.032; df = 2; LO=0.000 & H=0.179; **PCLOSE >** 0.000 **=** 0.257										



Notes: MC01= On Time, MC02 = Within Cost, MC03=Meet Quality Metrics, MC04=Within Scope, MC05=Project Team must be satisfied, **Correlation is significant at the 0.01 level (2-tailed)

Figure 5.2: Standardised solution of the measurement model: Project success criteria

The goodness-of-fit indices of the final measurement model for project success criteria are: (X^2 /df =2.016; p-value =0.133 > 0.05; GFI=0.989; AGFI =0.947; NFI=0.988; IFI=0.994; TLI=0.982; CFI=0.994; RMR=0.007 and RMSEA=0.074). These findings provide evidence of excellent model fit as all the model fit indices have outclassed the recommended threshold values, which further supports unidimensionality of the construct (see Table 5.31).

Moreover, the final retained variables (criteria) loaded very well onto the latent variables (project success criteria) ranging from 0.743 and 0.935 > 0.50, showing factorability of the items on the construct (construct validity) (Hair *et al.* (2010). Furthermore, the findings also proved that the observed variables converged very well on the construct (convergent validity is ensured) as the average variance extracted (AVE) value of 0.596 >0.50.

Similarly, the findings provide adequate evidence for discriminant validity of the measurement model, as firstly, none of the correlation coefficients was > 0.70 (Hair *et al., 2*010), and secondly, the square root of AVE of 0.772 exceeded its associating correlation between the variables (Fornell & Larcker, 1981, Schaupp, Carter & McBride, 2010). In addition, a Cronbach's alpha value of 0.829 > 0.60 threshold shows the reliability of the data and content validity (see Table 5.32 and 5.33).

Table 5.32: Observed variables Correlation: Project success criteria

	MC01	MC02	MC03	MC04
MC01	1.000			
MC02	0.454**	1.000		
MC03	0.642**	0.609**	1.000	
MC04	0.471**	0.585**	0.554**	1.000

Notes: MC01= On Time, MC02 = Within Cost, MC03=Meet Quality Metrics, MC04=Within Scope, **Correlation is significant at the 0.01 level (2-tailed)

Table 5.33: Standardised Regression Weights: (Group number 1-Default model)

Factor naming	Codes	Item names	Estimates	AVE	CR	α
Project Success Criteria (SC)	MC01	The deployment must be on Time (Schedule)	0.752	0.596	0.772	0.829
	MC02	The deployment must be within Cost (budget)	0.626			
	MC03	The deployment must meet Quality metrics (such as availability; data speed; voice quality, clarity etc.)	0.935			
	MC04	The deployment must be within Scope (meeting requirement or speciation)	0.743			

Notes: AVE: Average Variance Extracted = **(**Summation of squared factor loading) / (summation of squared factor loading) + (summation of error variances); CR: Composite Reliability = (Square Root of AVE) (Fornell & Larcker (1981); **α =** Cronbach's Alpha

From the findings presented above, it can be confirmed that the criteria used in measuring project success in telecommunication industry are delivery project **on time, within cost, meeting quality metrics** and **within scope.** The standardised regression weights postulate that meeting quality metrics has the highest consideration constituting 94% in determining project success followed by on time (75%), within scope (74%) and cost (63%) in Table 5.33.

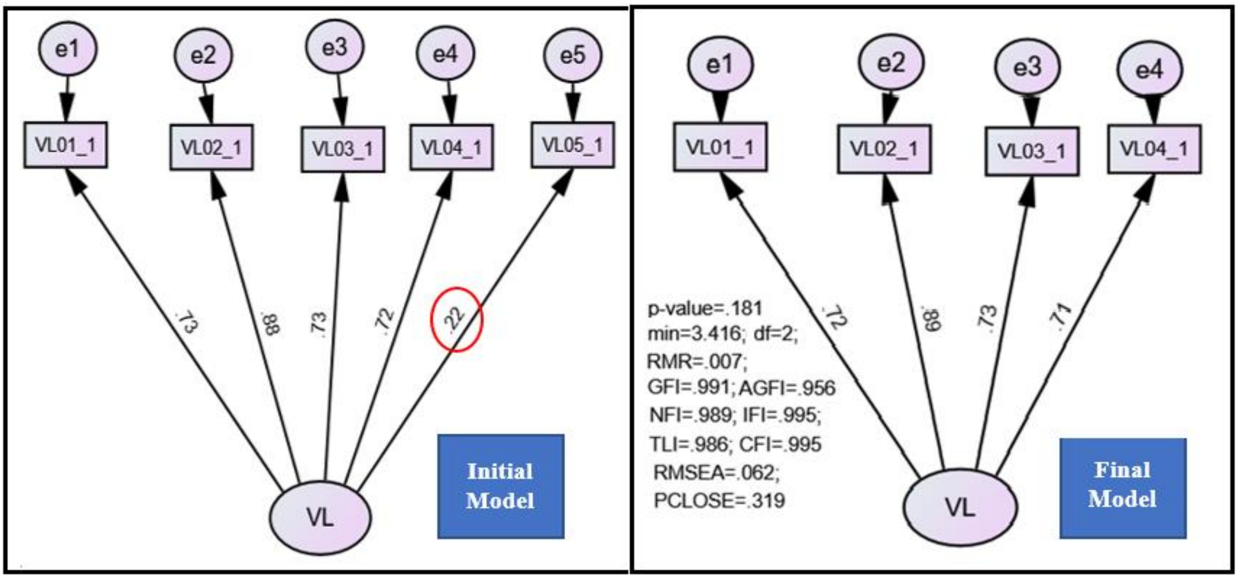
5.7.2.3 Measurement Model: Measures of value leaks

The measures of value leaks are the foundation on which the study's objectives were achieved. Descriptive analysis on the measures of value leaks through CFA aimed to establish the measures that propel the occurrence of value leaks during cell site deployment. The initial measurement model showed that all the factor loadings (TO=0.73, CO=0.88, PQ=0.73 & UP=0.72) exceeded the recommended threshold of > 0.50 (Hair *et al.*, 2010) except TD, which had factor loading of 0.22 < 0.50 (see Figure 4.3).

It is therefore evident that TD is neither a success measuring criteria nor a measure of value leaks (see Table 5.6, Table 5.34 and Figure 5.3). After the deletion of TD and without any modification, the final model fit ensued, as presented in Figure 5.3, Table 5.34 and 35.

Table 5.34: CFA fit indices: Measures of value leaks

Goodness of Fit Measures	**X^2 /df**	**p-value**	**RMR**	**GFI**	**AGFI**	**NFI**	**IFI**	**TLI**	**CFI**	**RMSEA**
Recommended Value	≤ 5.0	> 0.05	≤ 0.05	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90	< 0.08
Measurement Model	1.708	0.181	0.007	0.991	0.956	0.989	0.995	0.986	0.995	0.062
Notes: X^2 = 3.416; df = 2; LO=0.000 & H=0.170; **PCLOSE >** 0.000 **=** 0.319										



Notes: VL= Value leaks, VLO1=Time overrun, VLO2 =Cost Overrun, VLO3=Poor quality, VL04=Out of scope and VL05 =Team dissatisfaction.

Figure 5.3: Standardised solution of the measurement model: Measures of Value Leaks

The final model fit statistics shows (X^2/df =1.708; p-value =0.181 > 0.05; GFI=0.991; AGFI =0.956; NFI=0.989; IFI=0.995; TLI=0.986; CFI=0.995; RMR=0.007 and RMSEA=0.062). All these model fit indices were within the recommended threshold values, explaining the unidimensional validity of the construct (see Table 5.34).

Furthermore, the findings showed that all the standardised parameter estimates of the initial measurement model were significant at p=0.000 (Criterion validity), and all the critical ratios were ≥ 2.00, which further support the unidimensionality of the construct (see Appendix 5.3c).

Table 5.35: Observed variables correlation matrix: Measures of value leaks

	VL01	VL02	VL03	VL04
VL01	1.000			
VL02	0.655**	1.000		
VL03	0.531**	0.628**	1.000	
VL04	0.473**	0.635**	0.555**	1.000

Notes: VL= Value leaks, VLO1=Time overrun, VLO2 =Cost overrun, VLO3=Poor quality, VL04=Out of scope and VL05 =Team dissatisfaction, **Correlation is significant at the 0.01 level (2-tailed)

Table 5.36: Standardised Regression Weights: (Group number 1-Default model)

Factor Naming	Codes	Item Names	Estimates	AVE	CR	α
Value Leaks Measures (VL)	VL01	Value leaks when deployment is not delivered on time	0.724	0.587	0.766	0.845
	VL02	Value leaks when deployment is not delivered within cost	0.887			
	VL03	Value leaks when deployment is not delivered within quality metrics	0.726			
	VL04	Value leaks when deployment is not delivered within scope	0.713			

Notes: AVE: Average Variance Extracted = **(**Summation of squared factor loading) / (summation of squared factor loading) + (summation of error variances); CR: Composite Reliability = (Square Root of AVE) (Fornell & Larcker (1981); **α =** Cronbach's Alpha

Moreover, the findings presented that both convergent validity and discriminant validity were recognised as the average variance extracted (AVE) value of 0.578 > 0.50 and CR value of 0.766 > 0.70 as well as correlation coefficients. In addition, all the correlation coefficients of the observed variable are less than 0.70 threshold. Also, with the

Cronbach's alpha value of 0.845 > 0.60 threshold shows reliability of the data and ensures content validity (see Tables 5.34 and 5.36).

Judging from the goodness-of-fit model indices, standardised regression weights, and standardised solution of the measurement model, it is therefore prudent to accept time overrun (TO), cost overrun (CO), poor quality (PQ) and out of scope (UP) as the measures of value leaks and an occurrence of any could constitute the presence of value leaks in the projects.

5.7.2.4 Measurement Model: Impacts of value leaks

The impact of value leaks on cell site project also enhances the achievement of all the objectives. The findings from EFA produced a total of 12 items forming two-factor correlated model. These items are further tested and verified with first and second-order measurement model confirmatory factor analysis and the findings are discussed as follows.

In generating the best model fit of the data, 3 out of 7 observed variables on Factor 1 (IVL10, IVL 18 and IVL08) were deleted. Similarly, two out of five observed variables on Factor 2 (IVL06 and IVL 01) were dropped (see Figure 5.4). The deletion resulted from the non-significant contributions by the variables, low factor loadings, and extreme standardised residual values and path estimates which support the theory by Bongomin (2016:152) that the fewer the items in the factor, the better the measures.

All the tested, verified and retained variables also loaded well onto the latent variables from 0.597 to 0.707 > 0.50, recognising construct validity, which is the factorability of the items on the construct (Hair *et al.* (2010) (see Table 5.37).

The findings also showed that all the standardised parameter estimates of the initial measurement model are all significant at p=0.000 and all critical ratios are ≥ 2.00, which represents the unidimensionality of the construct (Ya'acob, 2008), as shown in Appendix 5.3d.

The findings further indicated that all the model fit indices of the final measurement model of impacts of value leaks performed exceptionally well against the recommended threshold values, therefore, providing an indication of an adequate model fit of the data.

The model fit statistics of (X^2 /df =1.336; p-value =0.183 > 0.05; GFI=0.976; AGFI =0.947; NFI=0.946; IFI=0.986; TLI=0.977; CFI=0.985; RMR=0.023 and RMSEA=0.043) are all within the recommended threshold values, hence, an adequate model fit, also an indication of unidimensional validity of the construct (Lopez *et al.*, 2006), as in Table 5.37.

Table 5.37: CFA fit indices: Impacts of value leaks

Goodness of Fit Measures	X^2 /df	p-value	RMR	GFI	AGFI	NFI	IFI	TLI	CFI	RMSEA
Recommended Value	≤ 5.0	> 0.05	≤ 0.05	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90	< 0.08
Measurement Model	1.336	0.183	0.023	0.976	0.947	0.946	0.986	0.977	0.985	0.043
Notes: X^2 = 17.368; df = 13; LO=0.000 & H=0.090; **PCLOSE >** 0.000 **=** 0.549										

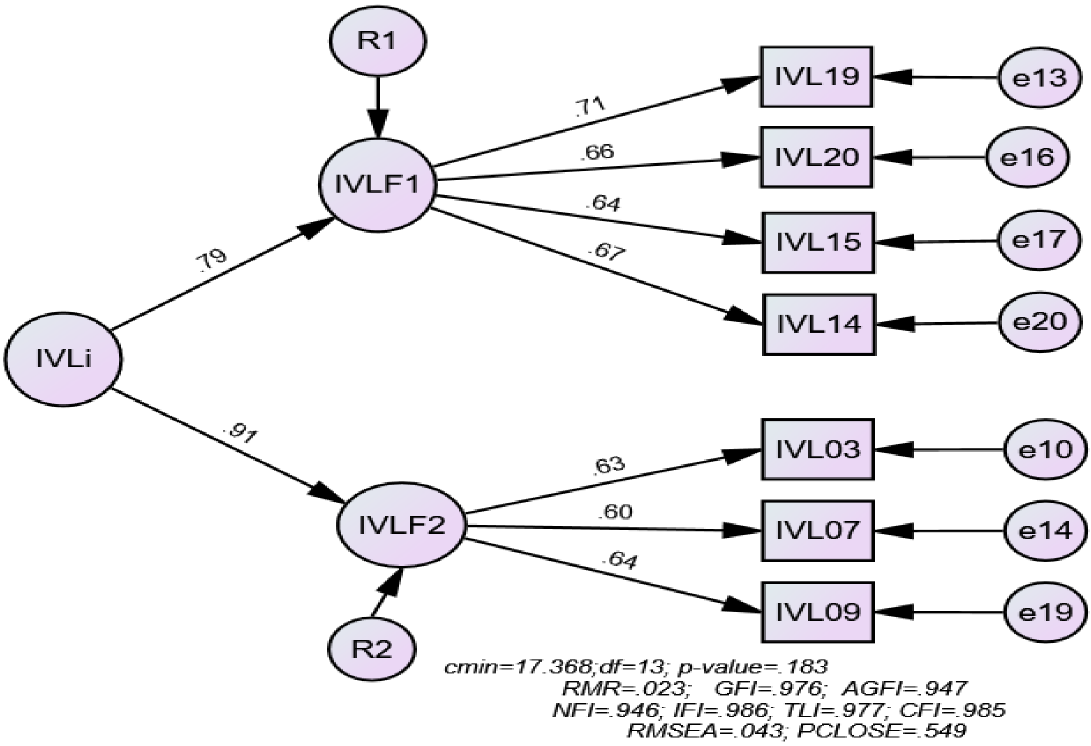


Figure 5.4: Standardised solution of measurement model: Impacts of value leaks

The findings again showed that the observed variables converged well on the construct with regards to AVE estimates for Factor 1 = 0.449 and Factor 2=0.384 with the respective CR values of 0.670 and 0.620. Although, the AVE estimates are little below 0.50 but have square root of AVE, estimates ≥ 0.60, hence, the observed variables converged on the constructs (Fornell & Larcker, 1981).

Similarly, the latent variables were distinct and unique from each other within the model (discriminant validity), as a correlation coefficient of 0.496 is less than 0.70 (Hair *et al.,* 2010).

Table 5.38: Standardised Regression Weights: (Group number 1-Default model)

Factor	Codes	Item names	Estimates	AVE	CR
Factor 1 (IVLF1)	IVL15	Value leak impacts projections in the business case	0.641	0.449	0.670
	IVL14	Value leak impacts profit rate of the supplier	0.674		
	IVL20	Value leak brings about rework impacting delivery timeliness	0.657		
	IVL19	Value leak increases the cost of the project	0.707		
Factor 2 (IVLF2)	IVL09	Value leak impacts the project objective of expanding network coverage and improving customer experience; i.e. congestions, data speed etc.	0.636	0.384	0.620
	IVL03	Value leak leads to revenue loss	0.625		
	IVL07	Value leak brings about Regulator fines	0.597		

Second-order Latent Variable	First-order Latent Variables	Estimates	Correlation Estimate
Impacts of Value Leak on deployment (IVL)	Factor I	0.791	0.496**
	Factor 2	0.910	

Notes: AVE: Average Variance Extracted = (Summation of squared factor loading) / (summation of squared factor loading) + (summation of error variances); CR: Composite Reliability = (Square Root of AVE) (Fornell & Larcker (1981); **p<0.01; F1<-->F2 = correlation coefficients between the factors.

In addition, the standardised regression weights for the default model showed the latent variables' (First-order Latent Variables) contributions to the global latent variables (Second-order Latent Variable) (see Figure 5.2 and Table 5.54). The findings revealed that Factor 1 (IVLF1) constitutes 79% and Factor 2 (IVLF2) constitutes 91% as an impact of value leaks in site projects (IVLi).

5.7.2.5 Measurement Model: Factors of value leaks

This section sought to test and verify the factors that cause value leaks during project management which addresses Objectives 1 and 2 of the study. In this study, first-order measurement model was first performed for each initial value leaks measure (time overrun, TO, cost overrun, CO; poor quality, PQ; and out of scope, UP), and furthermore, the subject the outcomes from each value leaks measure together to ascertain the integrated factors that cause value leaks to occur (Objective 1).

Furthermore, a second-order measurement model was performed with the outcome of the integrated factors that cause value leaks to ascertain their respective quantitative impacts on value leaks (Objective 2). Although, team dissatisfaction was found to not be part of the value leak measures, but because it occurs most often during project deployment (see Table 5.6), it was prudent to ascertain its causal factors, as added to the presentation below.

Measurement Model: Time overrun causal factors

Upon doing EFA, a total of 22 variables forming two-factor correlated model were further tested with confirmatory factor analysis. The findings from first-order measurement model showed an excellent model fit after deleting 5 out of 12 items on Factor 1 and 8 out of 10 items on Factor 2 (see Figure 5.5). The retained variables were all loaded very well onto the latent variables as shown in both Figure 5.5 and Table 5.40. The smaller variables retained in the factors was in line with an Item Response Theory, which states that the lesser the items the better the measures provided (Bongomin, 2016:152). Also, modification was performed to improve the model by drawing covariance between e25 and e26 (see Figure 5.5). All the factor loadings of the confirmed variables also loaded very well onto the latent variables with values from 0.661 to 0.836 > 05.0 threshold, exhibiting construct validity, which is factorability of the items on the construct (Hair *et al.*, 2010).

The goodness-of-fit indices of the final measurement model for time overrun measure are as follows: (X^2 */df* =1.368; p-value =0.104 > 0.05; GFI=0.961; AGFI =0.930; NFI=0.963; IFI=0.990; TLI=0.985; CFI=0.990; RMR=0.028 and RMSEA=0.044). All the model fit indices have met the recommended cut-off points, hence unidimensional validity of the construct (see Table 5.39).

The findings again showed that all the standardised parameter estimates of the initial measurement model were all significant at p=0.000 (Criterion validity) and all the critical ratios were ≥ 2.00, supporting the unidimensionality of the construct (see Appendix 5.3e).

Table 5.39: CFA fit indices: Time overrun causal factors

Goodness of Fit Measures	X² /df	p-value	RMR	GFI	AGFI	NFI	IFI	TLI	CFI	RMSEA
Recommended Value	≤ 5.0	> 0.05	≤ 0.05	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90	< 0.08
Measurement Model	1.368	0.104	0.028	0.961	0.930	0.963	0.990	0.985	0.990	0.044
Notes: X² = 34.194; df = 25; LO=0.000 & H=0.079; **PCLOSE >** 0.000 **=** 0.566										

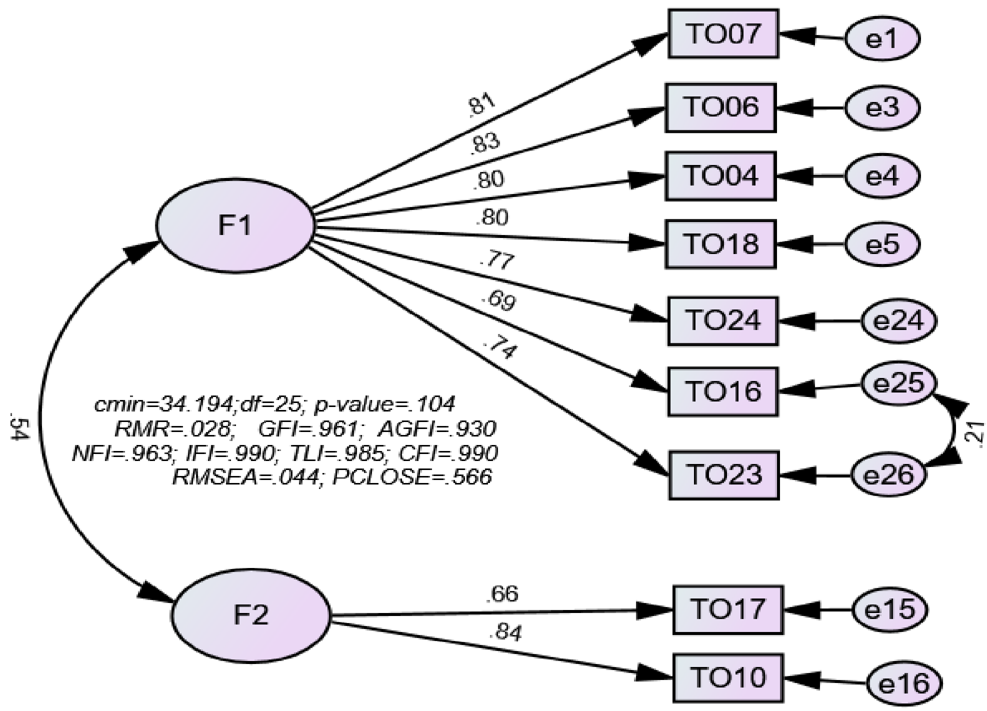


Figure 5.5: Standardised solution of the measurement model: Time overrun dimension

Additionally, the findings showed that both convergent validity and discriminant validity were attained as AVE values of 0.607 (Factor 1) and 0.568 (Factor) > 0.50 threshold, and CR values of 0.779 and 0.754 > 0.70. In addition, the correlation coefficients (F1<-->F2) of 0.541 was < 0.70 threshold (Hair *et al.*, 2010; Fornell & Larcker, 1981).

In summary, the model fits statistics for measuring the construct and the standardised regression weight estimates provide evidence that all the retained variables are indeed factors that cause time overrun, which would be further tested for the global latent variable (integrated factors for value leaks) in proceeding analysis.

Table 5.40: Standardised Regression Weights: (Group number 1-Default model)

Factor naming	Codes	Item Names	Estimates	AVE	CR
Factor 1 (TOF1)	TO07	Late issuing of Purchase Orders (POs)	0.811	0.607	0.779
	TO06	Delays in preparing the sites by the tower companies	0.828		
	TO04	Delay in seeking budget approval	0.803		
	TO18	Labour dispute (within the project team and the community)	0.804		
	TO23	Delay in material delivery since telecom equipment are not manufactured in-country but are imported	0.741		
	TO24	Landlords refusal to sign a contract for leasing of the land	0.765		
	TO16	Poor planning	0.693		
Factor 2 (TOF2)	TO17	Too many quality shortfalls that you have to do rework	0.661	0.568	0.754
	TO10	Inadequate project resources	0.836		
		F1<-->F2	0.541**		

Notes: AVE: Average Variance Extracted = **(**Summation of squared factor loading) / (summation of squared factor loading) + (summation of error variances); CR: Composite Reliability = (Square Root of AVE) (Fornell & Larcker (1981); **p<0.01; F1<-->F2 = correlation coefficients between the factors.

Measurement Model: Cost overrun causal factors

The EFA resulted in a total of 18 variables forming two-factor correlated model, were further tested and verified with confirmatory factor analysis (first-order measurement model) and the findings are discussed as follows.

The findings indicated that all the model fit indices of the final measurement model met the recommended threshold values, hence an indication of a good model fit of the data. The model fit statistics are: (X^2/df =1.237; p-value =0.221 > 0.05; GFI=0.972; AGFI =0.943; NFI=0.965; IFI=0.993; TLI=0.989; CFI=0.993; RMR=0.024 and RMSEA=0.036) as shown in Table 5.41. This adequate model fit displays the unidimensional validity of the construct (Lopez *et al.*, 2006).

Table 5.41: CFA fit indices: Cost overrun causal factors

Goodness of Fit Measures	X^2 /df	p-value	RMR	GFI	AGFI	NFI	IFI	TLI	CFI	RMSEA
Recommended Value	≤ 5.0	> 0.05	≤ 0.05	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90	< 0.08
Measurement Model	1.237	0.221	0.024	0.972	0.943	0.965	0.993	0.989	0.993	0.036
Notes: X^2 = 22.257; df = 18; LO=0.000 & H=0.078; **PCLOSE >** 0.000 **=** 0.662										

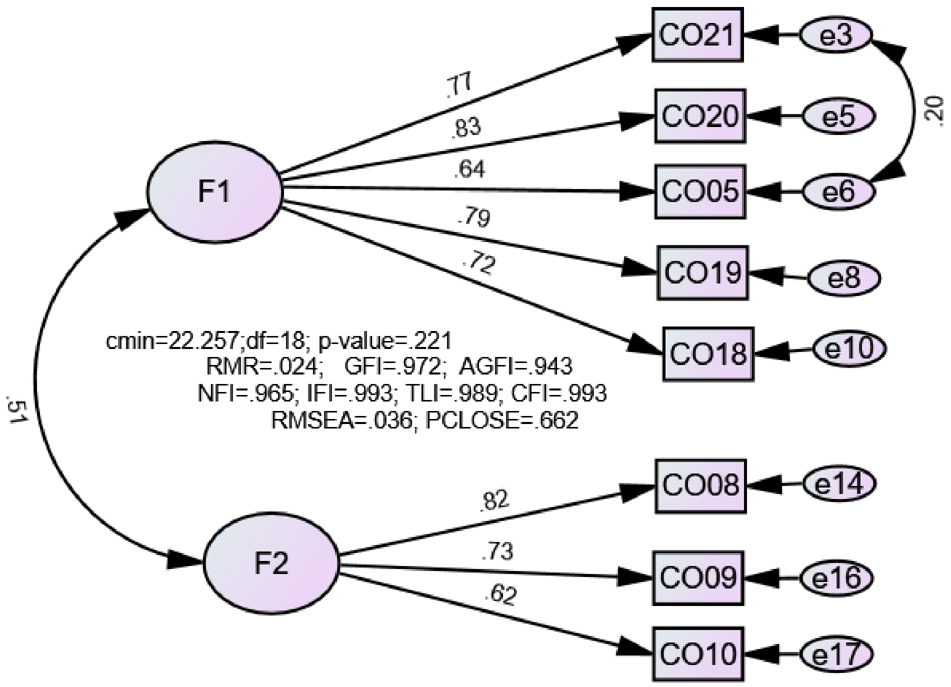


Figure 5.6: Standardised solution of the measurement model: Cost overrun dimension

The findings also showed that the factor loadings of the retained variables loaded well onto the latent variables, ranging from 0.620 to 0.834 > 0.50, demonstrating factorability of the items on the construct (construct validity) (Hair *et al.* (2010) as indicated in Table 5.42. Nevertheless, some items were deleted to achieve the required model fit: 7 out of 12 items in Factor 1(CO03, CO17, CO14, CO04, CO01, CO15 & CO11) and 3 out of 6 items in Factor 2 (CO12, CO07 & CO06), but the fewer the variables, the better the measures (Bongomin, 2016:152).

Again, covariance was drawn between e3 and e6 in a form of modification to enhance the model fit achievement (see Figure 5.6). In addition, the findings also showed that all the standardised parameter estimates of the initial measurement model were all significant at p=0.000 (Criterion validity) and all critical ratios were ≥ 2.00, further showing unidimensionality of the construct (Ya'acob, 2008) (see Appendix 5.3f).

Again, the findings also presented convergent validity as AVE values of 0.753 and 0.725 for both factor 1 and factor 2 respectively surpassed the threshold of >0.50. Equally, discriminant validity was ensured as CR estimates 0.868 and 0.851 > 0.70 and correlation coefficient value (F1<-->F2) of 0.506 < 0.70 (Hair *et al.*, 2010; Fornell & Larcker, 1981)— Table 5.42.

Therefore, the model fits statistics for measuring of the construct and the standardised regression weight estimates showed that all the retained variables are considered as causal factors for cost overrun occurrence (see Tables 5.41 and 5.42). These findings are further tested on a global latent variable (integrated factors of value leaks).

Table 5.42: Standardised Regression Weights: (Group number 1-Default model)

Factor naming	Codes	Item Names	Estimates	AVE	CR
Factor 1 (COF1)	CO21	Project manager's competency	0.768	0.753	0.868
	CO20	Poor contract management	0.834		
	CO05	Supplier is unable to commit adequate qualified resources to the project to control the impact on financial performance	0.638		
	CO19	Poor supervision and inspections	0.788		
	CO18	Unstable organisational environment	0.721		
Factor 2 (COF2)	CO08	Lack or poor communication skills	0.815	0.725	0.851
	CO09	Inadequate planning and scheduling	0.728		
	CO10	Inaccurate time and cost estimate	0.620		
		F1<-->F2	0.506**		

Notes: AVE: Average Variance Extracted = **(**Summation of squared factor loading) / (summation of squared factor loading) + (summation of error variances); CR: Composite Reliability = (Square Root of AVE) (Fornell & Larcker (1981); **p<0.01; F1<-->F2 = correlation coefficients between the factors.

Measurement Model: Poor quality causal factors

The total of 22 items forming two-factor correlated model from EFA were subjected to confirmatory factor analysis. The findings from first-order measurement model showed an adequate model fit as presented on the goodness-of-fit indices for the measurement model (see Table 5.43) and the standardised solution of the measurement model (see Figure 5.7).

In carrying out the CFA, 14 out of 17 items in Factor 1 and 1 out of 5 items in Factor 2 were all deleted to augment the model fit achievement of the data. The fewer the items in the factor, the better the measures (Bongomin, 2016:152). Similarly, modification was performed to enhance model fit by drawing a covariance between e20 & e21 and e19 & e21.

The goodness-of-fit indices of the final measurement model for factors that cause poor quality are as follow: (X^2 /df =1.718; p-value =0.063 > 0.05; GFI=0.972; AGFI =0.928; NFI=0.957; IFI=0.982; TLI=0.964; CFI=0.981; RMR=0.047 and RMSEA=0.062). Evidently, all the model fit indices have outperformed the recommended cut-off points, which is an indication of achieving best fit model and unidimensionality of the construct (see Table 5.43).

Table 5.43: CFA fit indices: Poor quality causal factors

Goodness of Fit Measures	**X^2 /df**	**p-value**	**RMR**	**GFI**	**AGFI**	**NFI**	**IFI**	**TLI**	**CFI**	**RMSEA**
Recommended Value	≤ 5.0	> 0.05	≤ 0.05	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90	< 0.08
Measurement Model	1.718	0.063	0.047	0.972	0.928	0.957	0.982	0.964	0.981	0.062
Notes: X^2 = 18.896; df = 11; LO=0.000 & H=0.108; **PCLOSE >** 0.000 **=** 0.298										

Furthermore, the findings showed that all the standardised parameter estimates of the initial measurement model were significant at p=0.000 (Criterion validity) and all critical ratios were ≥ 2.00, further supporting the unidimensionality of the construct (Ya'acob, 2008), see Appendix 5.3g.

Again, the findings also presented convergent validity as AVE values of 0.753 and 0.725 for both factor 1 and factor 2, respectively, exceeding the threshold of >0.50. Similarly, discriminant validity was ensured as CR estimates 0.868 and 0.851 > 0.70

and a correlation coefficient value (F1<-->F2) of 0.506 < 0.70 (Hair *et al., 2*010; Fornell & Larcker, 1981), see Table 5.44.

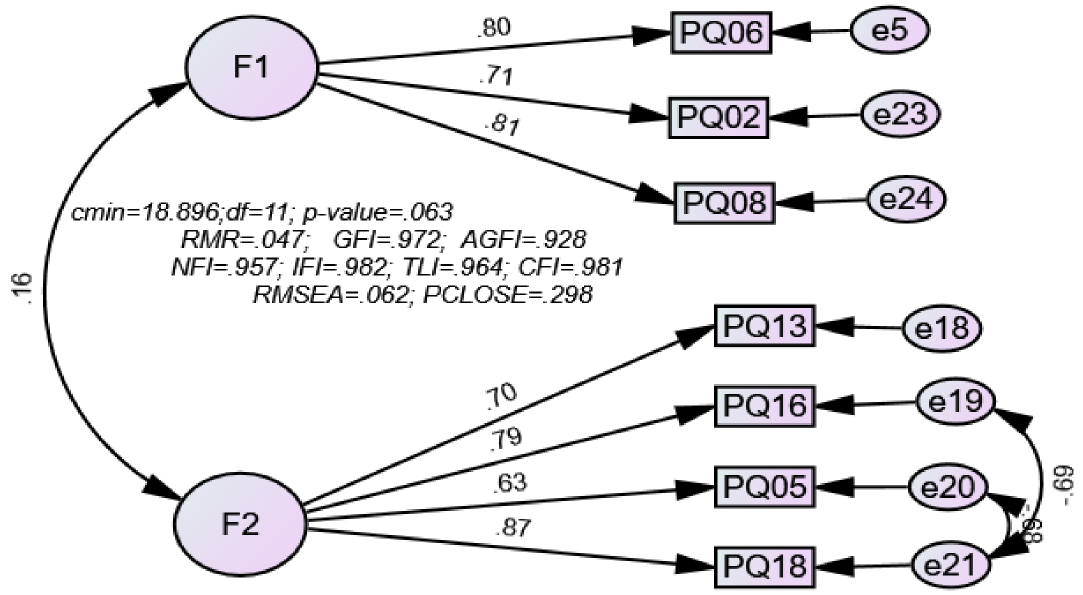


Figure 5.7: Standardised solution of the measurement model: Poor quality dimension

Table 5.44: Standardised regression weights: (Group number 1-Default model)

Factor naming	Codes	Item Names	Estimates	AVE	CR
Factor 1 (PQF1)	PQ08	Incompetence subcontractor or contractors	0.811	0.599	0.774
	PQ06	Excessive pressure to deliver the project	0.796		
	PQ02	Inexperienced project team and engineers	0.711		
Factor 2 (PQF2)	PQ13	Lack of quality focus	0.701	0.568	0.754
	PQ16	Changing quality needs during project implementation	0.794		
	PQ05	Unclear KPIs	0.631		
	PQ18	Lack of understanding of end-user requirement	0.866		
		F1<-->F2	0.16		

Notes: AVE: Average Variance Extracted = **(**Summation of squared factor loading) / (summation of squared factor loading) + (summation of error variances); CR: Composite Reliability = (Square Root of AVE) (Fornell & Larcker (1981); **p<0.01; F1<-->F2 = correlation coefficients between the factors.

From this model-generating approach, the items retained best describe the causal factors for the occurrence of poor quality in the cell site projects in accordance with the best model fits statistics and the standardised regression weight estimates presented in Table 5.44. These findings were further tested for the global latent variable (integrated factors of value leaks), as discussed below.

Measurement Model: Out of scope causal factors

The findings from EFA produced a total of 12 items, forming a two-factor correlated model. These items were further tested and verified with CFA (first-order measurement model) and the findings are discussed as follows.

The findings indicated that all the model fit indices of the final measurement model of out of scope measure performed exceptionally well against the recommended threshold values, hence, it is an indication of an adequate model fit of the data. In generating the best model fit of the data, 5 out of 7 items in Factor 1 (UP16, UP08, UP10, UP14 & UP06) were deleted but no item in Factor 2 was deleted and no modification was done (see Table 5.45 and Figure 5.8).

All the tested, verified and retained variables also loaded well onto the latent variables from 0.518 to 0.956 > 05.0, showing construct validity, which is factorability of the items on the construct (Hair *et al.*, 2010), see Table 5.46.

Furthermore, the model fit statistics of (X^2 */df* =1.334; p-value =0.184 > 0.05; GFI=0.973; AGFI =0.943; NFI=0.948; IFI=0.986; TLI=0.978; CFI=0.986; RMR=0.032 and RMSEA=0.042) were all within the recommended threshold values, hence, an adequate model fit, which is an indication of unidimensional validity of the construct.

Table 5.45: CFA fit indices: Out of scope causal factors

Goodness of Fit Measures	**X^2 /df**	**p-value**	**RMR**	**GFI**	**AGFI**	**NFI**	**IFI**	**TLI**	**CFI**	**RMSEA**
Recommended Value	≤ 5.0	> 0.05	≤ 0.05	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90	< 0.08
Measurement Model	1.334	0.184	0.032	0.973	0.943	0.948	0.986	0.978	0.986	0.042
Notes: X^2 = 17.337; df = 13; LO=0.000 & H=0.089; **PCLOSE >** 0.000 **=** 0.551										

The findings showed that all the standardised parameter estimates of the initial measurement model were significant at p=0.000, and all the critical ratios exceeded ≥ 2.00, supporting the unidimensionality of the construct (Ya'acob, 2008; Lopez *et al.*, 2006) (see Appendix 5.3h).

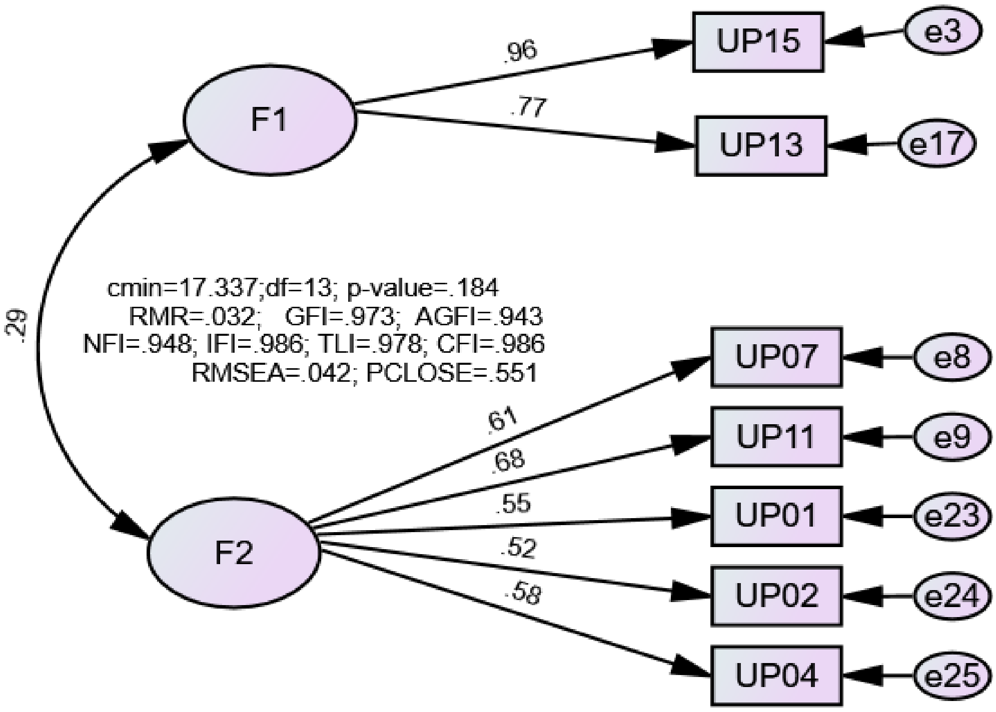


Figure 5.8: Standardised solution of the measurement model: Out of scope dimension

In addition, all the Cronbach's alpha values for Factor 1 = 0.924 and Factor 2 = 0.725 > 0.60 showed recognition of content validity and reliability. Because all the items measure the content they are designed for as well as showing internal consistency across the various items in the instrument without bias (Patel, 201; Choi, 2010; Hair *et al.*, 2010) (see Table 5.17).

Moreover, convergent validity and discriminant validity were followed, although the observed variables in Factor 1 converged excellently with AVE value = 0.757 > 0.50 and CR value = 0.870 > 0.70 (Hair *et al.* (2010), but Factor 2 had AVE value = 0.348 < 0.50 with CR value = 0.590, which is much closer to 0.60 acceptable threshold (Fornell & Larcker, 1981)

Table 5.46: Standardised regression weights: (Group number 1-Default model)

Factor naming	Codes	Item names	Estimates	AVE	CR
Factor 1	UP13	Terrain (project environment)	0.956	0.757	0.870
	UP15	Different geographical locations	0.774		
Factor 2	UP07	Unclear scope requirements	0.612	0.348	0.590
	UP11	Issue with top management support	0.675		
	UP01	Lack of detailed scope	0.548		
	UP02	Scope creep	0.518		
	UP04	Poor communication skills	0.585		
		F1<-->F2	0.294**		

Notes: AVE: Average Variance Extracted = **(**Summation of squared factor loading) / (summation of squared factor loading) + (summation of error variances); CR: Composite Reliability = (Square Root of AVE) (Fornell & Larcker (1981); **p<0.01; F1<-->F2 = correlation coefficients between the factors.

Therefore, the model fit statistics and standardised regression weights provide evidence that these retained variables are indeed the factors that cause out of scope in cell site projects. These retained factors of out of scope are further tested with CFA for integrated causal factors for value leaks (global latent variable), as discussed later in this chapter.

Measurement model: Team dissatisfaction dimension (TD)

Although the findings from previous analysis (see Table 5.6, Figure 5.2 and Figure 5.3) proved that TD is not a measure of value leaks, but since it occurs frequently during project deployment (see Table 5.6), it is therefore imperative to still determine the factors that cause its occurrence. The findings could enhance project team management and also improve project management in practice.

In view of this, the conduct of EFA produced a total of 15 items forming three-factor correlated model. These items were subjected to further test with CFA. The findings from first-order measurement model showed an adequate model fit. Preceding the achievement of the final model fit, some items were deleted: 1 out of 6 items in Factor 1 (TD08); 3 out of 7 items in Factor 2 (TD15, TD18 & TD14) and entire Factor 3 with two items (TD12 & TD22). In addition, modification was done to improve the model by drawing covariance between e7 and e11 (see Table 5.47 and Figure 5.9).

Furthermore, the standardised parameter estimates of the initial measurement model were all significant (p<0.000) (see Appendix 5.3i). The findings of goodness-of-fit indices of the final measurement model for team dissatisfaction are as follows: (X^2 */df* =1.345; p-value =0.116 > 0.05; GFI=0.962; AGFI =0.932; NFI=0.951; IFI=0.987; TLI=0.981; CFI=0.987; RMR=0.033 and RMSEA=0.043). These model fit indices have met and outperformed the recommended threshold values, hence providing evidence of excellent model fit as shown in Table 5.47.

Table 5.47: CFA fit indices: Team dissatisfaction causal factors

Goodness of Fit Measures	**X^2 /df**	**p-value**	**RMR**	**GFI**	**AGFI**	**NFI**	**IFI**	**TLI**	**CFI**	**RMSEA**
Recommended Value	≤ 5.0	> 0.05	≤ 0.05	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90	< 0.08
Measurement Model	1.345	0.116	0.033	0.962	0.932	0.951	0.987	0.981	0.987	0.043
Notes: X^2 = 33.620; df = 25; LO=0.000 & H=0.077; **PCLOSE >** 0.000 **=** 0.590										

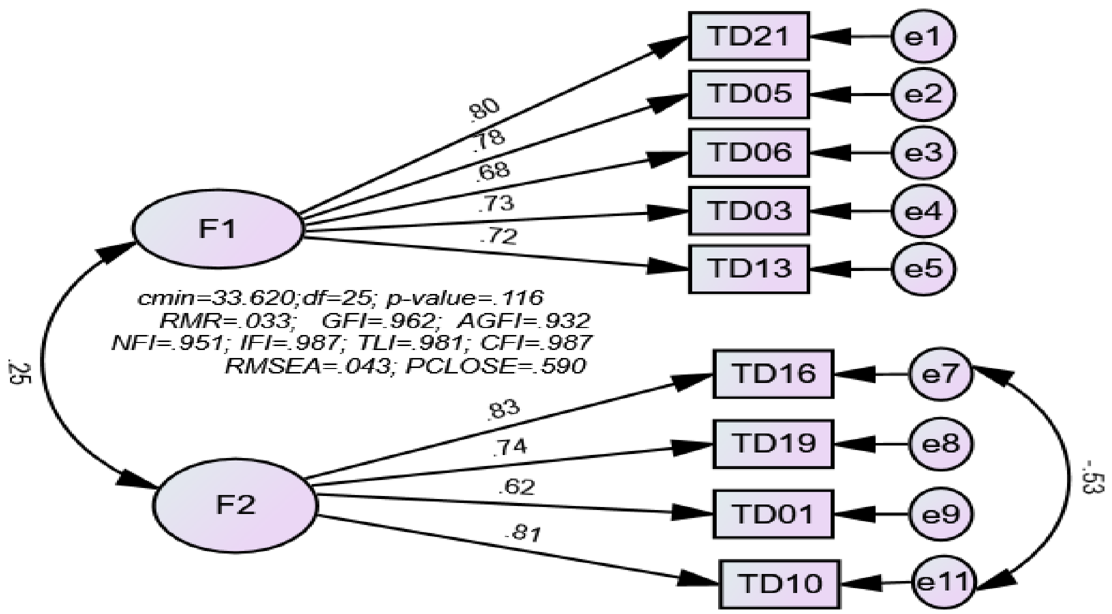


Figure 5.9: Standardised solution of the measurement model: Team dissatisfaction causal factors

In terms of the validity of the data, the good model fit showcases the unidimensional validity of the construct (Lopez *et al.*, 2006) (see Table 5.47). The retained variables also loaded well onto the latent variables, ranging from 0.621 to 0.826 > 0.50, exhibiting the factorability of the items on the construct, namely, construct validity (Hair *et al.* (2010).

The findings also proved that the observed variables converged well on the construct (convergent validity), as AVE values of 0.552 and 0.567 for both factor 1 and factor 2, respectively, exceeded the threshold of >0.50 (Hair *et al.,* 2010).

Similarly, the findings provide evidence of the discriminant validity of the measurement model, as the CR estimates for both factor 1=0.743 and factor 2= 0.753 are more than the 0.70 threshold, and the correlation coefficient value = 0.249 between the factors < 0.70 (Hair *et al.*, 2010; Fornell & Larcker, 1981), as indicated in Table 5.48.

Resulting from above discussion, the model fit statistics for measuring team dissatisfaction and its adequate standardised regression weights estimates indicated that all the retained variables are undeniably the factors that cause team dissatisfaction during cell site deployments in the telecommunication industry (see Table 5.48).

Table 5.48: Standardised regression weights: (Group number 1-Default model)

Factor naming	Codes	Item names	Estimates	AVE	CR
Factor 1	TD21	Poor or Lack of motivation and monetary rewards	0.801	0.552	0.743
	TD05	Excessive pressure from Project Manager	0.782		
	TD06	Extra working hours	0.678		
	TD03	Poor client and vendor relationships	0.730		
	TD13	Project Manager’s incompetence	0.718		
Factor 2	TD16	Changes in organisational management and leadership	0.826	0.567	0.753
	TD19	Cumbersome organisational processes	0.736		
	TD01	Politics within the organisation and its negative effect	0.621		
	TD10	Politicking among team members	0.811		
		F1<-->F2	0.249**		

Notes: AVE: Average Variance Extracted = (Summation of squared factor loading) / (summation of squared factor loading) + (summation of error variances); CR: Composite Reliability = (Square Root of AVE) (Fornell & Larcker (1981); **p<0.01; F1<-->F2 = correlation coefficients between the factors.

Measurement Model: Integrated causal factors of value leaks

This section sought to integrate the CFA findings from four measures of value leaks (time overrun, cost overrun, poor quality, out of scope) to generate an overall model fit in which those retained items (observed variables) would be considered as the final set of factors that cause value leaks resulting in achieving Objectives 1 and 2.

To this end, a total of 31 items under four measures (TO = 9, CO =8, PQ = 7 & UP = 7), each measure forming a two-factor correlated model were altogether tested and verified with CFA, and the findings from the first-order measurement model are presented on the goodness-of-fit indices (see Table 5.49), the standardised solution of the measurement model (see Figure 5.9) and standardised regression weights (see Table 5.49).

The goodness-of-fit indices of the final measurement model for the integrated factors of value leaks are: (X^2 */df* =1.313; p-value =0.071 > 0.05; GFI=0.947; AGFI =0.914; NFI=0.924; IFI=0.981; TLI=0.973; CFI=0.980; RMR=0.030 and RMSEA=0.041). These findings provide evidence of excellent model fit, as all the model fit indices have met the recommended threshold values as shown in Table 5.49.

Table 5.49: CFA fit indices: Integrated factors of value leaks

Goodness of Fit Measures	**X^2 /df**	**p-value**	**RMR**	**GFI**	**AGFI**	**NFI**	**IFI**	**TLI**	**CFI**	**RMSEA**
Recommended Value	≤ 5.0	> 0.05	≤ 0.05	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90	< 0.08
Measurement Model	1.313	0.071	0.030	0.947	0.914	0.924	0.981	0.973	0.980	0.041
Notes: X^2 = 63.033; df = 48; LO=0.000 & H=0.067; **PCLOSE >** 0.000 **=** 0.689										

Prior to achieving the final model fit, some observed variables were deleted, and modification was performed to enhance the overall model fit. These deleted observed variables involve: 6 out of 9 under TO; 5 out of 8 under CO; 4 out of 7 under PQ and 4 out of 7 under UP. This deletion was necessitated through low factor loadings, the insignificant contributions to the latent variables, extreme standardised residual values and path estimates. Hence, the fewer the items in the factor, the better the measures (Bongomin, 2016:152). To the same end, a modification was performed by drawing a covariance between e29 and e30.

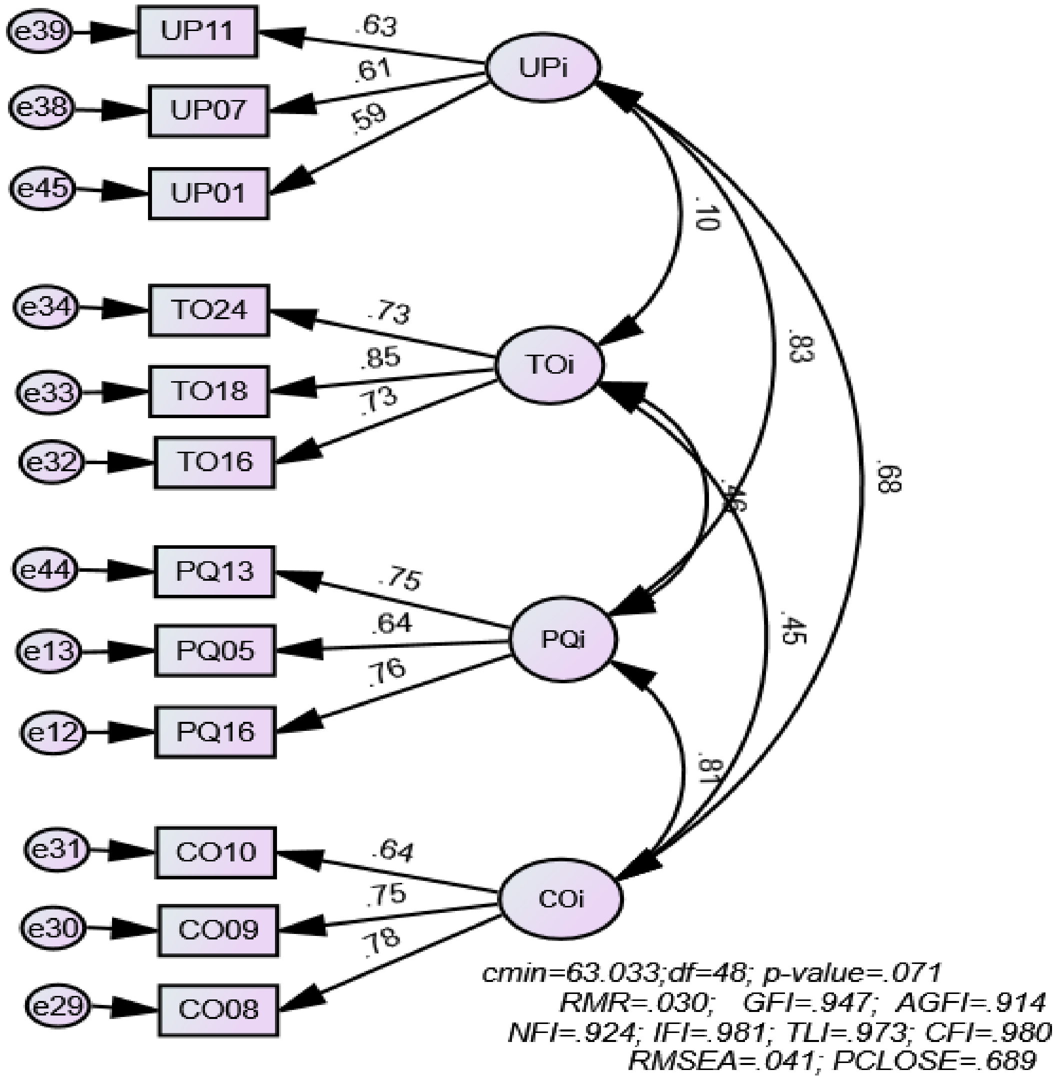


Figure 5.10: Standardised solution of the measurement model: Integrated factors for value leaks

With regards to the validity of the data for the integrated factors for value leaks, the adequate model fit showcases the unidimensional validity of the construct (Lopez *et al.*, 2006) (see Table 5.50). In addition, the findings showed that all the standardised parameter estimates of the initial measurement model were significant at p=0.000, and all critical ratios surpassed ≥ 2.00, which further supports unidimensionality of the construct (Ya'acob, 2008) (see Appendix 5.3j).

The final retained variables loaded well onto the latent variables between 0.584 and 0.853 > 0.50, showing factorability of the items on the construct (construct validity) (Hair *et al.* (2010). Furthermore, the findings also proved that the observed variables converged very well on the construct (convergent validity is ensured), as the AVE values of CO = 0.509, TO=0.599, PQ =0.517 exceeded the threshold of >0.50 (Hair *et* *al.,* 2010), and UP=0.370 < 0.50 with CR > 60 meet the guidelines by Fornell and Larcker (1981) (see Table 5.51).

Table 5.50: Latent construct correlation

	TO	CO	PQ	UP
TO	**0.713**			
CO	0.371**	**0.774**		
PQ	0.377**	0.626**	**0.719**	
UP	0.081	0.472**	0.5 82**	**0.608**
AVE	0.509	0.599	0.517	0.370

Notes: AVE: Average Variance Extracted= **(**Summation of squared factor loading) / (summation of squared factor loading) + (summation of error variances); **p<0.01; Diagonal numbers (bold) are CRs = (Square Root of AVE); **numbers= correlation coefficients between the constructs

Table 5.51: Standardised regression weights: (Group number 1-Default model)

Factor naming	Codes	Item names	Estimates	AVE	CR
Cost Overrun (CO)	CO08	Lack or poor communication skills	0.760	0.509	0.713
	CO09	Inadequate planning and scheduling	0.729		
	CO10	Inaccurate time and cost estimate	0.648		
Time Overrun (TO)	TO16	Poor planning	0.734	0.599	0.774
	TO18	Labour dispute (within the project team and the community)	0.853		
	TO24	Landlords refusal to sign a contract for leasing of the land	0.728		
Poor Quality (PQ)	PQ16	Changing quality needs during project implementation	0.763	0.517	0.719
	PQ05	Unclear KPIs	0.639		
	PQ13	Lack of quality focus	0.749		
Out of Scope (UP)	UP07	Unclear scope requirements	0.607	0.37	0.608
	UP11	Issue with top management support	0.632		
	UP01	Lack of detailed scope	0.584		

Second-order Latent Variable	First-order Latent Variables	Estimates
Value Leaks (VL)	UP	0.799
	TO	0.535
	PQ	0.987
	CO	0.841

Notes: AVE: Average Variance Extracted = **(**Summation of squared factor loading) / (summation of squared factor loading) + (summation of error variances); CR: Composite Reliability = (Square Root of AVE) (Fornell & Larcker (1981);

Similarly, the findings provide adequate evidence for discriminant validity of the measurement model, as first, none of the correlation coefficients was > 0.70 (Hair *et al., 2*010) and secondly, the square root of AVEs of all the unobserved variables exceeded the correlation between the latent variables (Fornell & Larcker, 1981, Schaupp *et al., 2*010), as presented in Table 5.51.

Further to achieving the factors that cause value leaks (Objective 1), Objective 2 of the study sought to determine quantitatively, the impact of the causal factors on value leaks. In view of this, a second-order measurement model was performed (see Table 5.51 and Appendix 5.3j) and the findings showed that poor quality (PO) has the highest impact of 99% to the occurrence of value leaks, followed by cost overrun (CO) with impact of 84%, out of scope (UP) with impact of 80% and time overrun (TO) with the impact of 54% on value leaks occurrence during site projects.

These second-order estimates of the measures were also subjected to aggregated percentage analysis to ascertain the measures contribution to the value leaks amount found in the descriptive analysis as shown in Table 5.51.

The findings revealed that out of the total value leaks amount of $100 000, poor quality factors have highest contribution of $31 000, followed by cost overrun factors with $27 000; out of scope factors with $25 000 and time overrun factors with $17 000.

Table 5.52: Aggregated percentage analysis of the value leaks amount

Causal factors	CFA 2nd-Order Estimates	Aggregated percentage	Contribution to value leaks amount
Time Overrun factors	54	17%	$17 000
Cost Overrun factors	84	27%	$27 000
Poor Quality factors	99	31%	$31 000
Out of scope factors	80	25%	$25 000
Total	**317**	**100%**	**$100 000**

Notes: Value leaks Amount=$100 000; Aggregated Percentage = (i.e., 54/317*100=17%); Measure contribution to Value Leaks Amount (i.e., 17/100*$100 000 = $17 000).

From the above discussion, all the indications, namely, the model fits statistics, standardised regression weight estimates, and the standardised solution of the measurement model provide evidence that the final 12 retained integrated variables under the identified four measures (see Table 5.51) are unquestionably the factors that cause value leaks in project management with regards to cell sites projects.

5.7.2.6 Measurement model: Sources of value leaks

This section sought to test the sources of the value leaks' causal factors during project management before the conduct of structural model to fully address Objectives 3 and 4 of the study. These causal factors are viewed from the project stakeholders, project environment and project life cycle as their potential sources of origin. The findings of the CFA are presented below.

Measurement Model: Project stakeholder

The findings from EFA presented a total of 16 items forming a three-factor correlated model. These items were further subjected to first-order measurement model CFA, and the findings are discussed as follows:

In generating the final model fit of the data, 4 out of 7 items on Factor 1 (PS16, PS08, PS20, PS14) were deleted. In the same way, 1 out of 4 items on Factor 3 (PS05) was dropped, but no item on Factor 2 was deleted (see Figure 4.11).

Similarly, a modification was performed to enhance the model by drawing covariance between e7 and e9. The deletion was occasioned from the non-significant contributions and low factor loadings, which supports the theory by Bongomin (2016:152) that the fewer the items in the factor, the better the measures.

The factor loadings of the retained variables loaded well onto the latent variables from 0.562 to 0.798, which exceeded the cut-off point of 0.50, presenting construct validity, which is factorability of the items on the construct (Hair *et al.,* 2010) (see Table 5.54). The findings similarly showed that all the standardised parameter estimates of the initial measurement model were significant at p=0.000, and all the critical ratios were ≥ 2.00, which represents unidimensionality of the construct (Ya'acob, 2008), as indicated in Appendix 4.3k.

The findings further showed that all the model fit indices of the final measurement model performed remarkably well against the recommended threshold values, hence, an indication of unidimensionality validity of the construct (Lopez *et al.*, 2006) (see Table 5.53). The model fit statistics of (X^2 /df =1.375; p-value =0.057 > 0.05; GFI=0.951; AGFI =0.919; NFI=0.918; IFI=0.976; TLI=0.967; CFI=0.976; RMR=0.037 and RMSEA=0.045) were all within the recommended threshold values.

The findings again showed that the observed variables converged quite well on the construct considering AVE estimates of 0.515, 0.462 and 0.418 with corresponding CR values 0.718, 0.680 and 0.647 which conform to the guidelines by Fornell and Larcker (1981). Additionally, the latent variables showed uniqueness within the model (discriminant validity), as the correlation coefficients were less than the 0.70 threshold (Hair *et al.*, 2010), as presented in Table 5.53.

Table 5.53: CFA fit indices: Factors from project stakeholder

Goodness of Fit Measures	**X^2 /df**	**p-value**	**RMR**	**GFI**	**AGFI**	**NFI**	**IFI**	**TLI**	**CFI**	**RMSEA**
Recommended Value	≤ 5.0	> 0.05	≤ 0.05	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90	< 0.08
Measurement Model	1.375	0.057	0.037	0.951	0.919	0.918	0.976	0.967	0.976	0.045
Notes: X^2 = 55.010; df = 40; LO=0.000 & H=0.072; **PCLOSE >** 0.000 **=** 0.590										

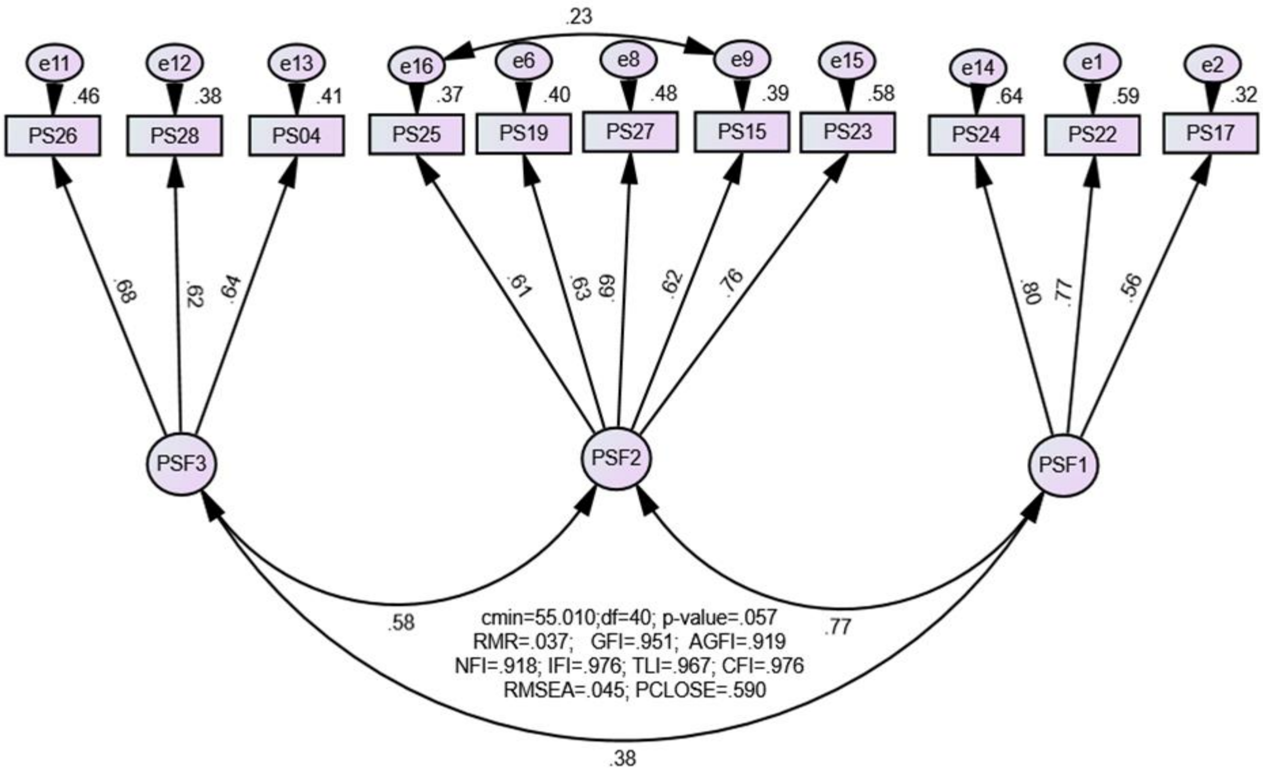


Figure 5.11: Standardised solution of the measurement model: Project stakeholders

Table 5.54: Latent construct correlation

	PSF1	PSF2	PSF3
PSF1	1.000		
PSF2	0.578**	1.000	
PSF3	0.300**	0.440**	1.000
AVE	0.515	0.462	0.418
CR	0.718	0.680	0.647

Notes: AVE: Average Variance Extracted = (Summation of squared factor loading) / (summation of squared factor loading) + (summation of error variances); **p<0.01; Diagonal numbers (bold) are CRs = (Square Root of AVE); **numbers = correlation coefficients between the constructs.

The findings presented in the form of model fits statistics, standardised regression weights, latent construct correlation, and standardised solution of the measurement model are indicatives that the variables retained in Table 5.55 are undoubtedly the value leaks' causal factors that emanate from project stakeholders.

Table 5.55: Standardised regression weights: (Group number 1-Default model)

Factor	Codes	Item names	Estimates	AVE	CR
Factor 1 (PSF1)	PS22	Excessive restriction of project budget	0.769	0.515	0.718
	PS17	Issues of project funding	0.562		
	PS24	Over-specification	0.798		
Factor 2 (PSF2)	PS19	Changes in requirements	0.634	0.462	0.680
	PS27	Inadequate planning and scheduling	0.689		
	PS15	Land dispute	0.624		
	PS23	Poor site management and supervision	0.762		
Factor 3 (PSF3)	PS26	Issues with top management support	0.679	0.418	0.647
	PS28	Poor stakeholder management	0.619		
	PS04	Conflicts among project stakeholders	0.640		

Notes: AVE: Average Variance Extracted = (Summation of squared factor loading) / (summation of squared factor loading) + (summation of error variances); CR: Composite Reliability = (Square Root of AVE) (Fornell & Larcker (1981)

Measurement Model: Project environment

A total of 21 items, forming a two-factor correlated model from EFA, were further tested with CFA. The findings from the first-order measurement model showed an adequate model fit. The goodness-of-fit indices of the final measurement model for project environment are as follows: (X^2 */df* =1.314; p-value =0.083 > 0.05; GFI=0.952; AGFI =0.925; NFI=0.947; IFI=0.987; TLI=0.983; CFI=0.987; RMR=0.045 and RMSEA=0.041). All the model fit indices have met the recommended thresholds, hence, unidimensional validity of the construct (see Table 5.56).

The findings showed that all the standardised parameter estimates of the initial measurement model were significant at p=0.000 (Criterion validity) and all critical ratios were ≥ 2.00, supporting unidimensionality of the construct (see Appendix 5.3L).

Table 5.56: CFA fit indices: Project environment

Goodness of Fit Measures	X^2 /df	p-value	RMR	GFI	AGFI	NFI	IFI	TLI	CFI	RMSEA
Recommended Value	≤ 5.0	> 0.05	≤ 0.05	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90	< 0.08
Measurement Model	1.314	0.083	0.045	0.952	0.925	0.947	0.987	0.983	0.987	0.041
Notes: X^2 = 55.201; df = 42; LO=0.000 & H=0.068; **PCLOSE >** 0.000 **=** 0.673										

In line with achieving the final model fit, some observed variables were deleted, and modifications were performed to enhance the overall model fit. These deleted observed variables include: 6 out of 11 on Factor 1, and 4 out of 10 on Factor 2 resulting from low factor loadings and insignificant contributions to the latent variables. Hence, the fewer the items in the factor, the better the measures (Bongomin, 2016:152). A modification was also performed by drawing covariance between e4 and e5 to improve the final model fit (see Figure 5.12). The factor loadings of the retained variables loaded between 0.617 to 0.890 exceeding the 05.0 threshold, exhibiting construct validity (Hair *et al.*, 2010).

Furthermore, convergent validity and discriminant validity as the observed variables in Factor 1 converged excellently, with AVE value = 0.653 > 0.50 and CR value = 0.808 > 0.70 (Hair *et al.*, 2010), nevertheless, Factor 2 with AVE value = 0.482 was less than 0.50, but its associated CR value = 0.694 was greater than 0.60, an acceptable value per the guidelines of Fornell and Larcker (1981). Also, the correlation coefficient of 0.080 > 0.70 confirmed discriminant validity.

The variables presented in Table 5.58 are the value leaks' causal factors that stem from the project environment, as confirmed by the model fits statistics, standardised regression weights, latent construct correlation, and standardised solution of the measurement model (see Tables 5.56 and 5.57; Figure 5.12).

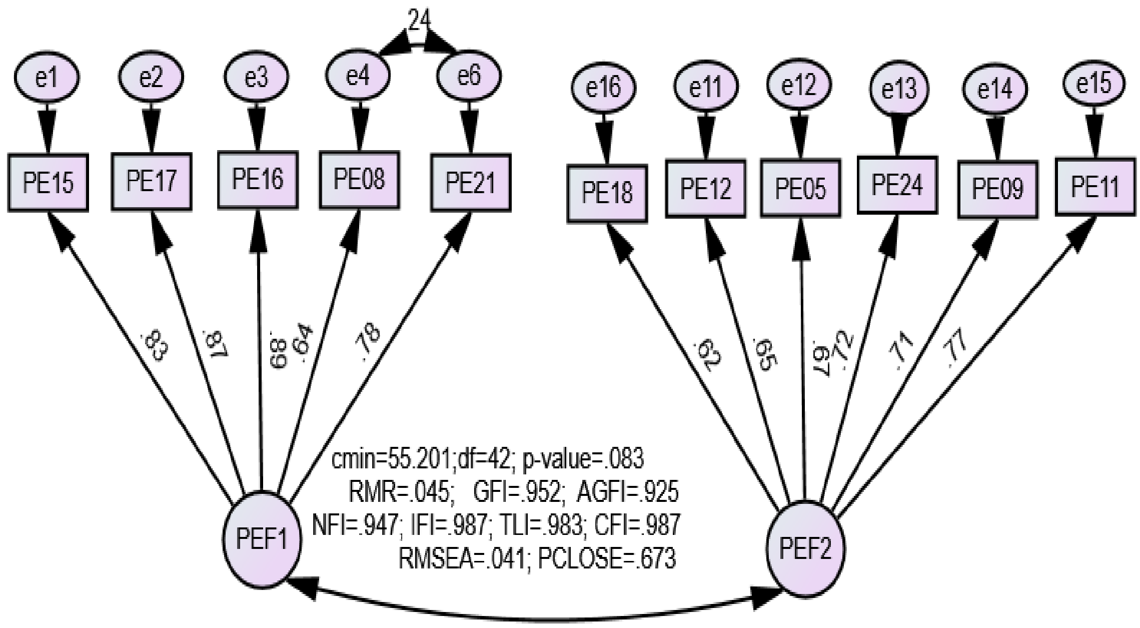


Figure 5.12: Standardised solution of the measurement model: Project environment

Table 5.57: Standardised Regression Weights: (Group number 1-Default model)

Factor	Codes	Item names	Estimates	AVE	CR
Factor 1 (F1)	PE21	Delay in material delivery	0.781	0.653	0.808
	PE15	Delays in preparing the sites by the tower companies	0.832		
	PE17	Delay in clearing the hardware from the port	0.874		
	PE16	Delay from the vendor side in importing the hardware into the country	0.890		
	PE08	Poor client-vendor relationship	0.639		
Factor 2 (F2)	PE11	Changes in organisational management and leadership	0.774	0.482	0.694
	PE09	Any form of labour disputes	0.712		
	PE24	Changes in materials cost (Inflation)	0.724		
	PE05	Cumbersome organisational processes	0.674		
	PE12	Forex exchange or exchange rate	0.654		
	PE18	Site permits by the communities	0.617		

F1<-->F2 **0.080**

Notes: AVE: Average Variance Extracted = **(**Summation of squared factor loading) / (summation of squared factor loading) + (summation of error variances); CR: Composite Reliability = (Square Root of AVE) (Fornell & Larcker, 1981).

Measurement Model: Project life cycle

The findings from EFA on project life cycle generated a total of 26 items forming four-factor correlated model. These items were further subjected to first-order measurement model to obtain the causal factors and second-factor measurement model to assess the impact of the latent variables on the global latent variable. The reason for the second-order measurement model is to determine which stage of the life cycle has the greatest impact on project success. The findings are therefore discussed as follows.

In line with reaching the final model fit, 9 out of 13 items on Factor 1 and the entire Factor 4 with two items were deleted. Similarly, 4 out of 7 items and 1 out of 4 items on Factor 3 and 4, respectively, were dropped. This deletion was necessitated through low factor loadings and non-significant factor contribution to the latent variables, as the fewer the items, the better the measures provided (Bongomin, 2016:152).

In addition, modification was performed to enhance the model fit by drawing covariance between e9 & e10 and e12 &13. The findings from the first-order measurement model showed an adequate model fit. The goodness-of-fit indices of the final measurement model for project life cycle are as follows: (X^2 */df* =1.412; p-value =0.067 > 0.05; GFI=0.958; AGFI =0.922; NFI=0.949; IFI=0.985; TLI=0.977; CFI=0.984; RMR=0.035 and RMSEA=0.047). All the model fit indices have outperformed the recommended thresholds, representing unidimensionality validity of the construct as shown in Table 5.58.

Table 5.58: CFA fit indices: Project life cycle

Goodness of Fit Measures	**X^2 /df**	**p-value**	**RMR**	**GFI**	**AGFI**	**NFI**	**IFI**	**TLI**	**CFI**	**RMSEA**
Recommended Value	≤ 5.0	> 0.05	≤ 0.05	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90	< 0.08
Measurement Model	1.412	0.067	0.035	0.958	0.922	0.949	0.985	0.977	0.984	0.047
Notes: X^2 = 42.357; df = 30; LO=0.000 & H=0.078; **PCLOSE >** 0.000 **=** 0.529										

In addition, the results showed that all items have factor loadings from 0.651 to 0.821, which is greater than 0.50 acceptable value (see Figure 5.13 and Table 5.60). These factor loadings show factorability of the items, ensuring construct validity (Hair *et al.*, 2010). Also, the findings present that the standardised parameter estimates of the initial measurement model were all significant (p<0.000) and the critical ratios (CR) meeting the acceptable threshold ≥ 2.00, further support the unidimensionality of the construct (Ya'acob, 2008:235) (see Appendix 5.3m).

Table 5.59: Latent Construct Correlation: Factors from project life cycle

	F1	F3	F2
F1	1.000		
F3	0.418**	1.000	
F2	0.479**	0.531**	1.000
AVE	0.515	0.462	0.418
CR	0.718	0.680	0.647

Notes: AVE: Average Variance Extracted = **(**Summation of squared factor loading) / (summation of squared factor loading) + (summation of error variances); **p<0.01; Diagonal numbers (bold) are CRs = (Square Root of AVE); **numbers= correlation coefficients between the constructs, F1=Project life cycle Factor 1, F2=Project life cycle Factor 2 and F3=Project life cycle Factor 3

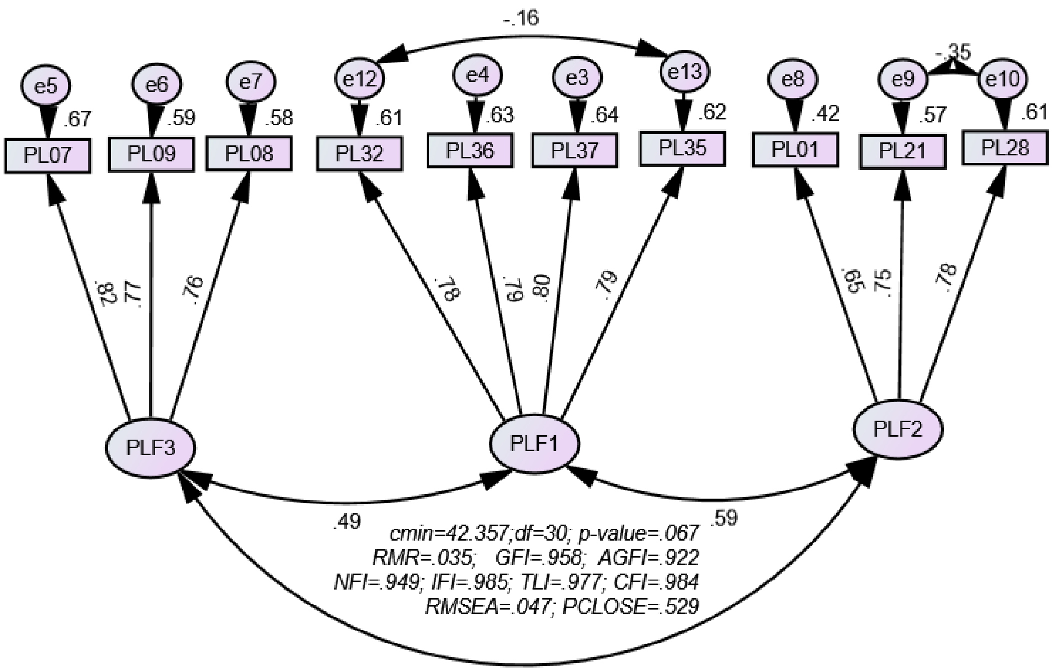


Figure 5.13: Standardised solution of the measurement model: Project life cycle

The AVE values of 0.626, 0534 and 0.615 with regards to Factor 1, 2 and 3, were above the recommended value of 0.50, hence, the observed variables converged on the constructs (Hair *et al.,* 2010; Fornell & Larcker, 1981). In the same way, discriminant validity was well presented, as the constructs were uniquely distinct from each other (Hair *et al.,* 2010). With this, square root of AVE, (composite reliability, CR) estimates, 0.791, 0.731 and 0.784 were all above 0.70 threshold and the correlation coefficients were within the recommended cut-off point < 0.70 (Hair *et al.,* 2010, Fornell & Larcker, 1981). Furthermore, the correlation coefficient values were significant at p <0.01 indicating criterion validity, which predicts the outcomes (Wong, 2002) (see Tables 5.60 and 5.61).

Finally, in determining which stage in the life cycle carries the highest impact on value leaks, the findings from the second-order measurement model (see Table 5.60 and Appendix 5.3m) showed that Factor 2 has the highest contribution of 88% to value leaks from project life cycle, followed by Factor 3 and Factor 1 with 73% and 67%, respectively. Yong and Pearce (2013) asserted that factors should be named with regards to what really represent them best. Based on the findings from the above discussion (see Tables 5.58 to 5.60 and Figure 5.12), the factors converged on Factor 1 are best represented by Initiation-related factors, Factor 2 by Planning-related factors, and Factor 3 by Execution-related factors.

Table 5.60: Standardised regression weights: (Group number 1-Default model)

Factor	Codes	Item names	Estimates	AVE	CR
Factor 1 (PLF1)	PL37	Inconsistent process for collecting product requirements in relation to the industry standards	0.801	0.626	0.791
	PL36	Excessive restriction of project budget	0.794		
	PL32	Incompetent subcontractors	0.782		
	PL35	Conflicting requirement	0.788		
Factor 2 (PLF23)	PL01	Poor contract management	0.651	0.534	0.731
	PL21	Poor or lack of communication skills among project stakeholders	0.752		
	PL28	Schedule delays	0.783		
Factor 3 (PLF3)	PL07	Delays in preparing the sites by the tower companies	0.821	0.615	0.784
	PL09	Delay in clearing the hardware from the port	0.766		
	PL08	Delay from the vendor side in importing the hardware into the country	0.765		

Second-Order Latent Variable	First-Order Latent Variables	Standardised Factor Loading
PL	Factor I	0.671
	Factor 2	0.882
	Factor 3	0.732

Notes: AVE: Average Variance Extracted= **(**Summation of squared factor loading) / (summation of squared factor loading) + (summation of error variances); CR: Composite Reliability = (Square Root of AVE) (Fornell & Larcker (1981)

5.7.2.7 Mapping of value leaks' causal factors to their proposed sources of origin

In the previous sections, the study performed CFA to establish measurement models fit for project success criteria, integrated factors that cause value leaks and their proposed sources of origin, as well as achieving the required reliability and validity of the dataset. This section therefore sought to firstly, map each of the integrated value leak causal factors to specific proposed sources of value leaks. The intent is to establish the sources of origin of these identified causal factors that cause value leaks during project deployment. Secondly, to map the proposed sources of value leaks to the project success criteria in order to examine the effect of these proposed sources on project success through structural model testing.

In view of this, the proposed sources of value leaks are considered as the independent variables and the project success criteria are considered as the dependent variable in addressing the second part of Objective 3 and to fully achieve Objective 4. The results of this mapping are exhibited in Figure 5.14 and elaborated on below the figure. Figure 5.14 depicts that the integrated causal factors from four (4) main measures of value leaks (time overrun, cost overrun, poor quality, and out of scope) (see Table 5.59) are linked to factors identified under project stakeholders, project environment and project life cycle (see Tables 5.59, 5.60, and 5.61), as their potential sources of origin.

In line with this, the factors that share common practical meanings are mapped together, although, the factors may have been expressed semantically differently but with common practical meanings. In delving into the specifics, in view of time overrun causal factors, namely, poor planning factor (TO16) is matched to the inadequate planning and scheduling factor (PS27) in project stakeholders, while the Landlord's refusal to sign a contract for leasing the land factor (TO24) is linked to the site permits by the communities factor (PE18) where the sites are being deployed within the project environment, and the labour dispute (within the project team and the community) factor (TO18) is also mapped to any form of labour dispute factor (PE09) in the project environment.

Moreover, in view of cost overrun causal factors, namely, the inadequate planning and scheduling factor (CO09) is linked to inadequate planning and scheduling factor (PS27) in the project stakeholder, the lack or poor communication factor (CO08) is matched to poor or lack of communication skills among project stakeholders' factor (PL21) in the project life cycle, and the inaccurate time and cost estimate factor (CO10) is linked to both the schedule delays factor (PL28) in the project life cycle and over-specification factor (PS24) in project stakeholders.

In addition, the poor quality causal factor, namely, the changing quality needs during project implementation factor (PQ16) is linked to changes in requirements factor (PS19) in the project stakeholder; the unclear KPIs factor (PQ05) is matched to the conflicting requirements factor (PL35) in the project life cycle, and the lack of quality focus factor can also be linked to the poor site management and supervision factor (PS23) in the project stakeholder, the incompetent subcontractor's factor (PL32) in the project life cycle, and the poor client-vendor relationship factor (PE08) in the project environment.

Lastly, in line with the out of scope causal factors, namely, the issue with top management support factor (UP11) is linked to both the issues with top management support factor (PS26) in the project stakeholder, and the changes in organisational management and leadership factor (PE11) in the project environment, while the unclear scope requirement factor (UP07) is matched to the conflicting requirement factor (PL35) in the project life cycle, and the lack of detailed scope factor (UP01) is also linked to the inconsistent process for collecting product requirement in relation to the industry standards factor (PL37).

In conclusion, the proposed sources for value leaks' causal factors (independent variables) are mapped to project success criteria (the dependent variable) for structural model testing in the next chapter.

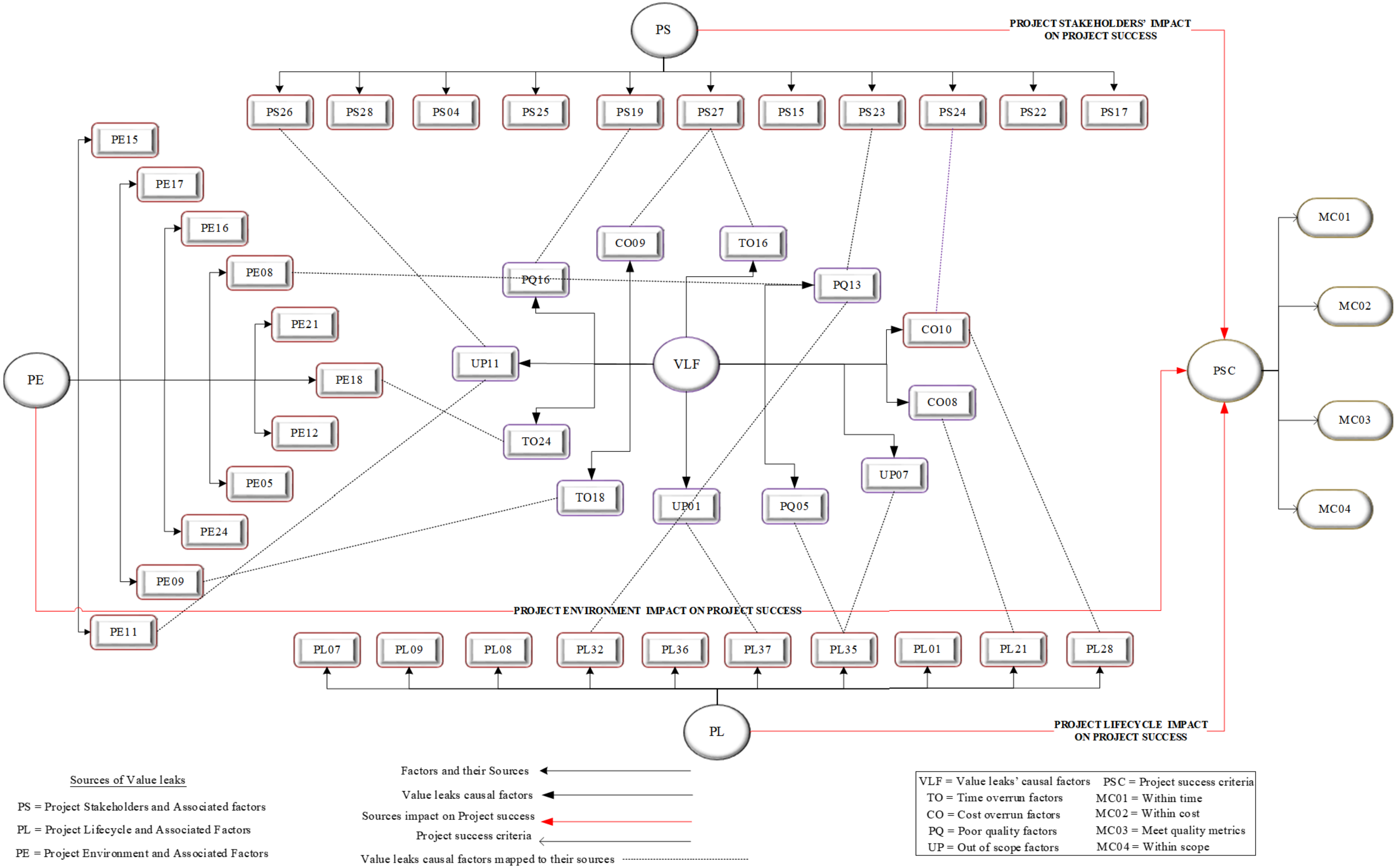


Figure 5.14: Mapping of value leaks' causal factors to their sources

Source: Researcher's construct from field data (2019)

5.8 STRUCTURAL EQUATION MODELLING ANALYSIS

According to Bryne (2010), SEM is designed to evaluate how well a proposed conceptual model could fit a set of collected data and examine the structural relationships between the latent variables. In view of this, the study adopted a structural model to test the conceptual model and explore the impacts of the various proposed sources of value leaks (stakeholders, project life cycle and environment) (independent variables) on project success (dependent variable) which answers Objectives 3 and 4 of the study. This section is preceded by CFA, whereby measurement model fits of the independent and dependent variables were established, as asserted by Hair *et al.* (1998) that CFA should be tested prior to the conduct of structural model. Subsequently, the structural model was produced and computed through the MLE procedure using AMOS 25.

5.8.1 Structural Model

The study applied the same set of fit indices used to examine the measurement models (see table 5.17) to evaluate and validate how good a proposed conceptual model could fit a set of collected data. The results of the structural model gives an indication of overall model fit to the dataset as all the fit indices have met the recommended thresholds as presented in Table 5.61 and Figure 5.14.

Table 5.61: Measures of the model fit

Goodness of Fit Measures	X^2 /df	p-value	RMR	GFI	AGFI	NFI	IFI	TLI	CFI	RMSEA
Recommended Value	≤ 5.0	> 0.05	≤ 0.05	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90	> 0.90	< 0.08
Structural Model	1.594	0.079	0.009	0.967	0.930	0.973	0.990	0.983	0.990	0.057
Notes: X^2 = 20.727; df = 13; LO=0.000 & H=0.100; **PCLOSE >** 0.000 **=** 0.364										

In line with the findings presented in Table 5.61 and Figure 5.15, the chi-square statistics (X^2/df) = 1.877 is within the acceptable value of ≤ 5.0, and its associated p-value is non-significant at 0.079 (p >0.05) showing overall model fit (Asoka, 2015; Rosseni, 2014; Kline, 2011; Hair *et al.,* 2010).

The rest of the fit indices are as follows: (GFI=0.967; AGFI =0.930; NFI=0.973; IFI=0.990; TLI=0.983; CFI= 0.990; RMR=0.009 and RMSEA=0.057). Both the Goodness-of-Fit Index (GFI) = 0.967 and Adjusted Goodness-of-Fit Index (AGFI) = 0.930 values exceeded the recommended value of 0.90 indicating how well the model fits a set of observations (Hair *et al.*, 2010; Hooper *et al.,* 2008).

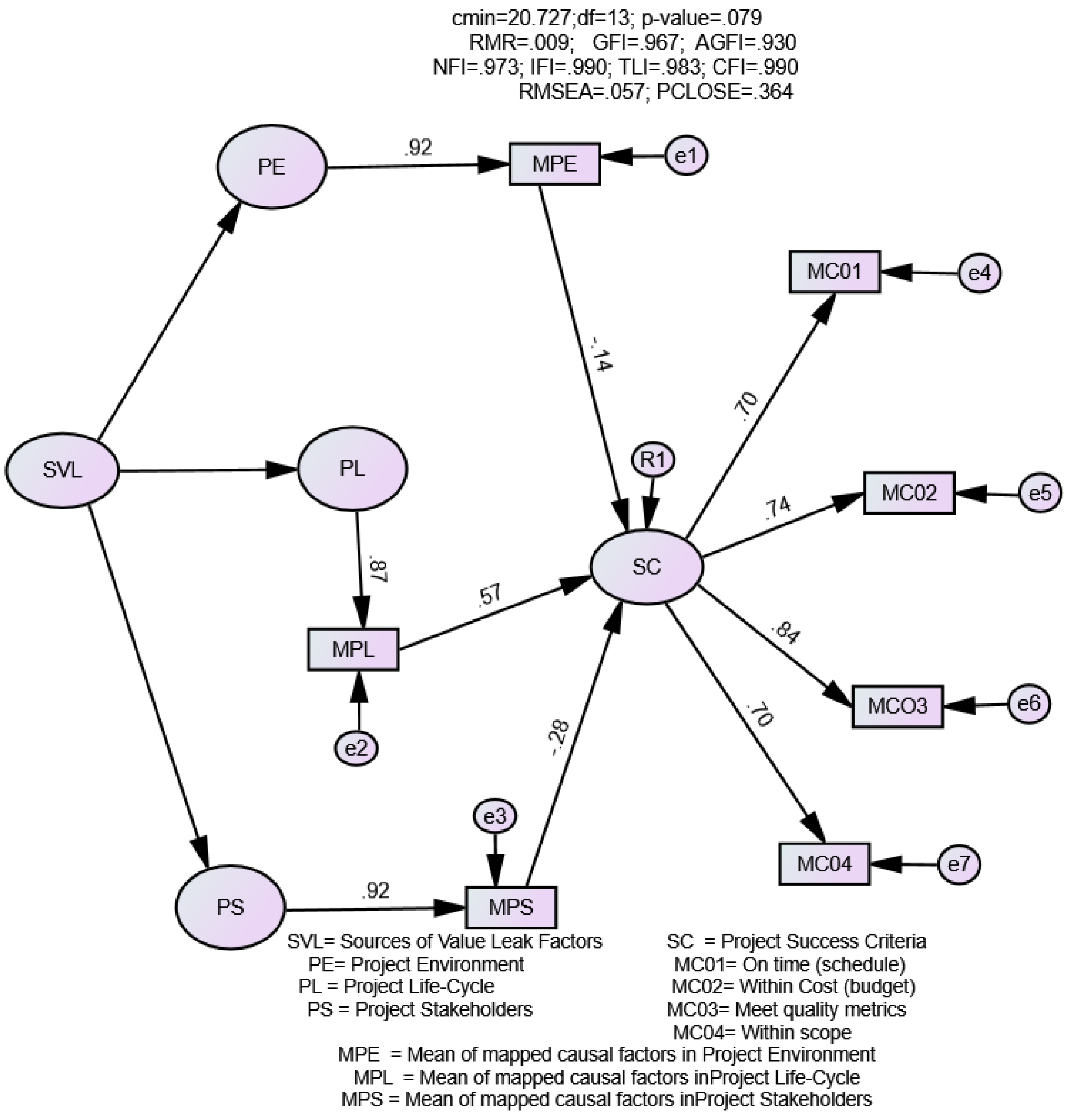


Figure 5.15: The structural model

Also, all the comparative indices (Normed Fit Index (NFI) = 0.973, Incremental Fit Index (IFI) = 0.990, Tucker Lewis Index (TLI) = 0.983, and Comparative Fit Index =0.990) exceeded the recommended value of > 0.90, providing evidence of the absolute fit of the specified model in comparison to the absolute fit of an independent model (Rosseni, 2014; Gaskin, 2012; Hair *et al.,* 2010; Hu & Bentler, 1999, 1998).

Moreover, the Root Mean Squared Residual (RMR) value of 0.009 falls within the pre-defined value of 0.050, which is the square root of the mean of the residuals between the observed variables and the estimated metrics. The results further revealed a Root Mean Square Error of Approximation (RMSEA) value of 0.057 which falls within the acceptable value of > 0.08, indicating how the model fit the population covariance matrix (Rosseni, 2014; Kline, 2011; Hair *et al.,* 2010) (see Table 5.61).

Lastly, the findings revealed that the causal factors mapped within project stakeholders loaded extremely well onto the structural model, with a standardised estimate of 0.920, followed by project environment with factor loadings of 0.918 and project life cycle with factor loadings of 0.866, as shown in Figure 5.15. In a nutshell, from the findings presented above, it is evident that the structural model provides an overall good fit to the dataset.

5.8.2 Assessing the impact of value leaks' sources on project success

This section sought to completely address Objective 3 of the study which asks the question: how do the different sources of value leaks (stakeholders, project life cycle, and environment) impact project success? In addressing this question, three (3) hypotheses were tested and verified as follows:

- H_1: The project stakeholder is considered to be a source of value leaks because its causal factors have a strong negative relationship with project success.
- H_2: The project environment is considered to be a source of value leaks because its causal factors have a strong negative relationship with project success.
- H_3: The project life cycle is considered to be a source of value leaks because its causal factors have a strong negative relationship with project success.

In line with this, the statistical significance of the structural parameter values was evaluated to test and validate the hypotheses. The findings from the structural coefficients are presented in Table 5.62. The findings indicate that the path that links project stakeholder to project success produces a negative significant coefficient value of -0.135 (SE=0.117, CR= -0.883). Therefore, the negative hypotheses direction supports the hypothesis that project stakeholders is a source of value leaks during project deployment. Similarly, the path that connects project environment to project success yields a negative significant coefficient value of -0.276 (SE=0.119 CR= -1.785), which supports the hypothesis that project environment is a source of value leaks' causal factors. Nevertheless, the path that links project life cycle to project success yields a positive significant coefficient value of 0.569 (SE=0.103 CR= 3.995), which does not support the hypothesis that project life cycle is a source of value leaks during project deployment. This rather suggests that project life cycle is a wheel on which a project is delivered successfully to achieve its value.

Table 5.62: Hypotheses testing: Impact value leaks sources on project success

Hypothesis	Path	Direction	Estimate (β)	Std. Error	CR	Remarks
H_1	PE → **SC**	-	-0.135	0.117	-0.883	Supported
H_2	PS → **SC**	-	-0.276	0.119	-1.785	Supported
H_3	PL → **SC**	+	0.569	0.103	3.995	Not Supported

Notes: N=187; PE=Project Environment; PS=Project Stakeholder; Project life cycle; CR=Critical ratio: p<0.05

5.9 CHAPTER SUMMARY

This chapter presented the findings from the quantitative research, the second phase of the study. The chapter began with data response rate analysis, and the response rate of 81% did not violate the multivariate analysis assumptions for factor analysis (Bashir & Hassan, 2018). Afterwards, data screening and missing value imputation were carried out, as 40% of the returned questionnaires were incomplete. An analysis of participants' profile and key characteristics was followed.

Subsequent to the demographic analysis, the study performed tests of multivariate analysis' assumptions, specifically, normality and multi-collinearity tests to assess the data's validity and suitability for conducting EFA, CFA and SEM. The findings indicated that data for the study did not violate the normality and multicollinearity tests' assumptions.

The study also performed descriptive analyses on the value leaks' dimensions prior to conducting EFA, CFA and SEM. The study performed EFA first, followed by CFA to assess the validity and reliability of the data. Finally, the study performed structural modelling to test the conceptual model and explore the impact of the various proposed sources of value leaks (stakeholders, project life cycle, and environment) (independent variables) on project success (dependent variable). In view of this, the statistical significance of the structural parameter values were evaluated to test and validate the hypotheses.

The following chapter presents discussions on the converged findings from the exploratory sequential mixed methods of the study.

CHAPTER 6:
SUMMARY OF FINDINGS AND DISCUSSIONS

6.1 INTRODUCTION

This chapter presents the summary of the findings and discussions in accordance with the overall aim and objectives of the research study. This chapter first presents a discussion of the contextual background findings as a preamble to the achievement of the study's overall aim. Subsequently, the findings from the research objectives are presented, culminating in the development of the value leaks diagnostic model as the overall aim of the study.

6.1.1 Contextual background findings

This section presents a discussion of the contextual background to the study. This discussion lays a strong foundation for achieving the objectives of the study, which culminates in the accomplishment of the overall aim of the study. The application of EVA to measure project performance is then discussed. This is followed by a discussion of how the telecommunication industry creates value through network expansion projects.

6.1.1.1 Application of EVA in the telecommunication sector

This section is extremely important to achieving the aim of proposing an inclusion of value leaks into EVA as a measure of project performance. In view of this, the findings indicated that the EVA technique is used for measuring cell site performance and reporting in the telecommunication industry based on project cost, schedule (time), and scope. This finding is in consistent with the assertions by previous studies that the EVA technique is a unit of standard measure to judge project performance based on cost, schedule, and scope (Rajhans *et al.*, 2016; Lukas, 2008; Noori *et al.*, 2008; DOD, 1997; Freeman & Beale, 1992;). In addition, this finding is supported by statement that the principles of EVA can be applied to all projects in any industry (PMI, 2013).

6.1.1.2 Telecommunication industry creation of value through network expansion project

In an era of value creation, projects are highly considered as an instrument to achieve value in organisations (Zwikael *et al.*, 2019). In support of this assertion, the findings from the study revealed that the telecommunication industry utilises site projects to achieve values in the form of network expanding capacity, meeting regulatory requirements, fixing network quality issues, such as traffic congestions, enhancing the user experience, increasing market share, and driving and increasing revenue. This finding supports the argument that business is set up to create value (Bowman & Ambrosini, 2000). In addition, the findings establish that the value in an infrastructure project, such as network expansion project, is measured during site deployment and post-site deployment. During-site deployment measures highlight the value based on meeting the go-live date (time), delivery within budget (cost), scope and meeting all the quality metrics (such as availability, data speed, voice quality and clarity).

In view of this, the findings on time, cost and scope confirm the diverse studies by the proponents of the triple constraints theory to measure project performance (Shenhar & Dvir, 2007; Wang & Huang, 2006; Nakashima *et al.*, 2006; Lewis, 2001; Ingram, 2000; Wateridge, 1995; Pinto & Slevin, 1990; De Wit, 1988; Morris & Hough, 1987). On the contrary, the project quality which is found as an important dimension, has been contended and disregarded by some of these previous authors, who argued that project performance should be measured based on the triple constraints (on time, on scope and on cost) (Muller & Jugdev, 2012; Shenhar & Dvir, 2007; Bardhan *et al.*, 2006; Nakashima *et al.*, 2006; Ingram, 2000). This finding contradicts such assertions by these authors and rather advocates an inclusion of quality into the project performance measuring criteria. This can serve as an extension to the triple constraint theory. Also, this finding on quality is consistent with the assertions by some other authors (Pedro *et al.*, 2011; Turner, 2009; Desmond, 2006; Koelmans, 2004) who indicated quality as part of the project measuring criteria. The post-site deployment focuses on value in network KPIs in the business case (customer satisfaction, revenue growth, project profit and loss, increased market share, capture high areas). This finding on post-site deployment differs significantly from the value measurement literature by the CBP (2005).

Furthermore, the findings revealed that network expansion projects are mainly undertaken to provide access to telecommunication services in both a greenfield (a completely new location where a tower is built) and brownfield or colocation (an upgrade on an existing site). The findings further revealed that the number of sites in a single project range from 250 to 300 sites, and its associated cost is considered extremely expensive. For example, the minimum cost for a site deployment in a greenfield is about US$ 100K to US$ 250K, and US$ 40K to US$ 100K in a brownfield, and it takes six months to two years to complete a greenfield deployment, and four to six months to complete a brownfield. Therefore, considering the insufficient information on network expansion projects (cell site projects) perceived in the literature, these findings are new information which can advance knowledge in field of project management.

6.2 OVERALL AIM OF THE STUDY

The overall aim of the study is to develop a diagnostic model that aids value leaks to easily be identified, controlled, and remedied to minimise the forgone unrealised project value as well as unplanned utilisation of resources. This overall aim was achieved through a number of objectives outlined below:

6.2.1 Research objectives

The following objectives for the research were utilised to achieving the overall aim of the study:

- Critically analyse value leaks' causal factors during project management;
- Examine quantitatively, the impact of the identified value leaks' factors on project performance success;
- Explore the impact of different sources of value leaks (stakeholders, project life cycle, and environment) on project performance success; and
- Develop a diagnostic model (conceptual framework) of value leaks during project implementation in the context of telecommunication construction projects.

6.2.2 Research questions

The research objectives to achieve overall aim of the study were formulated from below research questions:

- What are the factors that contribute to value leaks during project management?
- To what extent do value leaks' causal factors impact project performance?
- How do different source of value leaks (stakeholders, project life cycle, and environment) impact project success?

- To what extent can a diagnostic model of value leaks be developed for project management practitioners in telecommunication network expansion projects?

6.3 DISCUSSION OF THE FINDINGS

This section discusses the findings from Chapter 4 and Chapter 5 based on the research questions as presented below.

6.3.1 Research question 1:

What are the factors that contribute to value leaks during project management?

The objective of question 1 sought to critically analyse the value leaks' causal factors during project management. The identification of the value leak causal factors is important in devising appropriate strategies to achieve business value through the value-creation process. The reason why value is not materialised is because there is a lack of understanding of the reasons for their occurrences (Keen, 2011).

To this end, the study found 12 integrated factors under four measures based on the confirmatory factor analysis results, as the factors that cause value leaks during network expansion project deployment in the telecommunication sector. Although, on the individual measure's level, a number of factors were ascertained but by integrating these factors together, 12 factors were retained which are discussed based on their respective measures of value leaks: time overrun, cost overrun, poor quality, and out of scope.

Time overrun causal factors

From the CFA results, the finding shows that time overrun is a determinant of value leaks in the telecommunication network expansion projects. The finding also revealed that time overrun is the additional time used to complete the project activities after missing out the initial finish date. Although time overrun occurs sometimes during site project deployment, its duration varies across the companies within the telecommunication industry.

The repercussion of time overrun is that it has a financial impact for both the operator (telco) and the vendor (contractor), it prolongs project go-live date, increases project cost, team dissatisfaction sets in, and the overall impact is loss of revenue and value. The integrated factors found to cause time overrun are discussed next:

- *Poor planning:* the fiercely competitive nature of the telecommunication sector and the routine deployment of cell site projects by the players in this industry are observed to have made a proper planning activity less of a focus in project deployment. From the study, the project management team claimed to have mastered the act of deploying network expansion project, and this familiarity seems to cause them to not spend enough time on planning from end-to-end. This poor planning attitude can lead to the occurrence of time overruns, causing value leaks during value creation through network expansion projects. This finding is in contrast with previous studies (Murray & Seif, 2013; Rahman *et al.*, 2013; Ameh *et al.*, 2010), which found improper or inadequate planning to be only a cost overrun causal factor in both telecommunication and construction projects.
- *Labour dispute (within the project team and the community):* the study revealed that the supposed health hazards associated with cell site projects generate agitation among community members in the areas where the project takes place, according to the project management practitioners. Community members that are against the project prevent the project team from accessing the project area. The telecommunication players mostly rely on regulatory permits to undertake the project, and do not properly engage the community members ahead of the implementation. This brings about disagreements between the project team at the site and the community members, which increases the project timelines and leads to time overruns. Labour disputes seem to be a common phenomenon in Ghana, as confirmed by Bentil *et al.*'s (2017) study into the level of existence and impact of cost and time overruns on construction projects in Ghana. Additionally, this finding is in accordance with the assertion by DOE (2008) as a factor to cause time overrun.
- *Landlord's refusal to sign a contract for leasing of the land:* In Ghana, landlords are among the opinion leaders in the communities where network expansion projects are carried out. In combination with community agitation on the health-related issues regarding such projects, the landlords are also seen to show hesitation to lock down their pieces of land for such a long period of time because the mounting of cell sites stays as long as the company remains in operation. As found in the

study, in as much as the landlords want money, they are unwilling to agree to the contract terms, and such indecisiveness prolongs the commencement of the project, resulting in time overrun which brings about value leaks. This factor is seen as a new addition to the existing time overrun causal factors' information in the literature.

Cost overrun causal factors

The CFA results show that cost overrun is evidence of the occurrence of value leaks during a network expansion project. From the finding, cost overrun is seen as spending more money on the project than its estimated budget. The study further revealed that a site project sometimes goes over budget which has a financial impact on the revenue realisation by the operator and the profit rate of the supplier, as well as impacting service quality. With the value leaks integrated factors found from the CFA, the below factors are found to cause cost overruns:

- *Poor communication skills:* the study revealed that the network expansion project involves parties from different orientations, such as the opinion leaders, regulator, government agencies, the equipment manufacturer, core project management team, contractors, subcontractors, the communities, and landlords. In view of this, the project manager and his team require effective communication skills to be able to manage all these parties related to the project. Poor communication with these stakeholders could result in an increase in project costs. The nature of these project activities include negotiations, sourcing, estimation, scheduling, and so forth. These activities require good communication skills to be able to achieve the needed value, and if that is not achieved, it leads to cost overruns. This finding, therefore, confirms the previous study by Taherdoost and Keshavarzsaleh (2016), and the assertion by the PMI (2017) that communication skills can impact the satisfaction of project stakeholders.
- *Inadequate planning and scheduling:* as previously mentioned, the attitude of regarding themselves as experts in terms of carrying out network expansion projects leads to project teams neglecting the effectiveness of planning and scheduling the project from end-to-end, as revealed by the study's findings. This inadequate planning and scheduling bring about cost overruns during deployment, leading to the occurrence of value leaks. This finding is consistent with Rahman *et*

al.'s (2013) study into the factors related to cost overrun in the construction industry.

- *Inaccurate time and cost estimate:* the cost and time involved in network expansion projects differ from one location to the other in terms of transportation cost, cost of labour, the demands of the community, regulatory requirements, climatic conditions of the area, the level of resource experience, and so forth as, found in the study. With regards to the repetitive nature of this project, as observed, the same blueprint with just a few adjustments are usually used without taking into consideration most of these factors before seeking budget approval from the board or top management. These inaccurate time and cost estimates therefore result in cost overrun, leading to value leaks during deployment. This finding is in line with the previous studies on the factors that cause cost overrun in the construction and building sectors (Bentil *et al.*, 2017; Ade-Ojo & BababIola, 2013; Murray & Seif, 2013; Pourrostam & Ismail, 2011).

Poor quality causal factors

The study found out that the issues of quality within the telecommunication sector are considered paramount in all the various spheres of the projects. As confirmed by the CFA results, the occurrence of poor quality during deployment constitutes value leaks. This finding on poor quality occurrence during project management is in accordance with the findings of previous studies (Newton, 2015; Love & Edwards, 2004; Verzuh, 2004; Love, 2002; Barber *et al.*, 2000; Willis & Willis, 1996; Abdul Rahman, 1993). However, none of these studies considered such an occurrence as value leaks. Conversely, although it is such an important dimension, EVA excludes it from the assessment of project performance. This finding, therefore, justifies the need to include poor quality into EVA as a measure of project performance, especially within the context of telecommunication projects. The CFA results on the integrated factors that cause value leaks through poor quality are discussed below:

- *Changing quality needs during project implementation:* the altering of project scope of work during deployment which may result from a strategic decision, climatic conditions at the site, a poor requirement gathering process, scope creep, time overrun, cost overrun, crashing or fast tracking, as found in the study, could bring about changes in quality requirements. Therefore, the decision to compromise on quality, for whatever reason, may lead to poor delivery of the quality metrics. This may perhaps necessitate rework to warrant the acceptance of the project outcome, resulting in value leaks. This finding, therefore, confirms the assertion that changing quality needs during project implementation causes poor quality (Newton, 2015).

- *Unclear KPIs:* the telecommunication companies sometimes specify too many KPIs in terms of quality metrics in the scope of work (SOW) for the undertaking contractors to achieve, as illustrated in Figure 6.1. This lack of clarity on such KPIs may bring about poor quality during performance measures in deployment. This factor is perceived as a new addition to the knowledge of project management.
- *Lack of quality focus:* with cell site projects, the usual mantra is 'when is the site going live?' Poor quality occurrence is mostly detected during the assessment of project performance. The implementing organisation's lack of focus on quality metrics throughout the project life cycle results in rework leading to value leaks, as found in the study. This finding supports the study by Love and Edwards (2004), who found a lack of quality focus, among others, as the underlying causes of rework in construction projects.

As additional information to the findings on poor quality, the study defined a situation whereby the outcome of the project does not meet the physical installation and the network performance KPIs. The specific metrics found in the telecommunication sector to assess network expansion project's quality culminated in the development of the "Cell Site Quality Metrics model", as shown in Figure 6.1.

From this figure, the evidence suggests that the quality metrics used to assess the quality of the delivery of site projects are grouped into two categories:

- Physical Structural Installation (PSI) Metrics which considers the accuracy of cable bending radius, cleanliness of the site, cable management, unbolting cabinets on the slabs, proper health and safety requirement, and so forth, and
- Network Performance/Regulatory (NPR) Metrics which looks at
  - the service availability metrics (Call/network carrying capacity, quality of signalling or network reception, availability of site, data experience, receiving latching onto the network etc.);

- service accessibility metrics (data throughput, clarity of voice calls, call drops, call setup times, the speed for the download and upload, latency, signal loss; and
- service retainability; which is the ability to continuously use the service at all time without any interruptions.

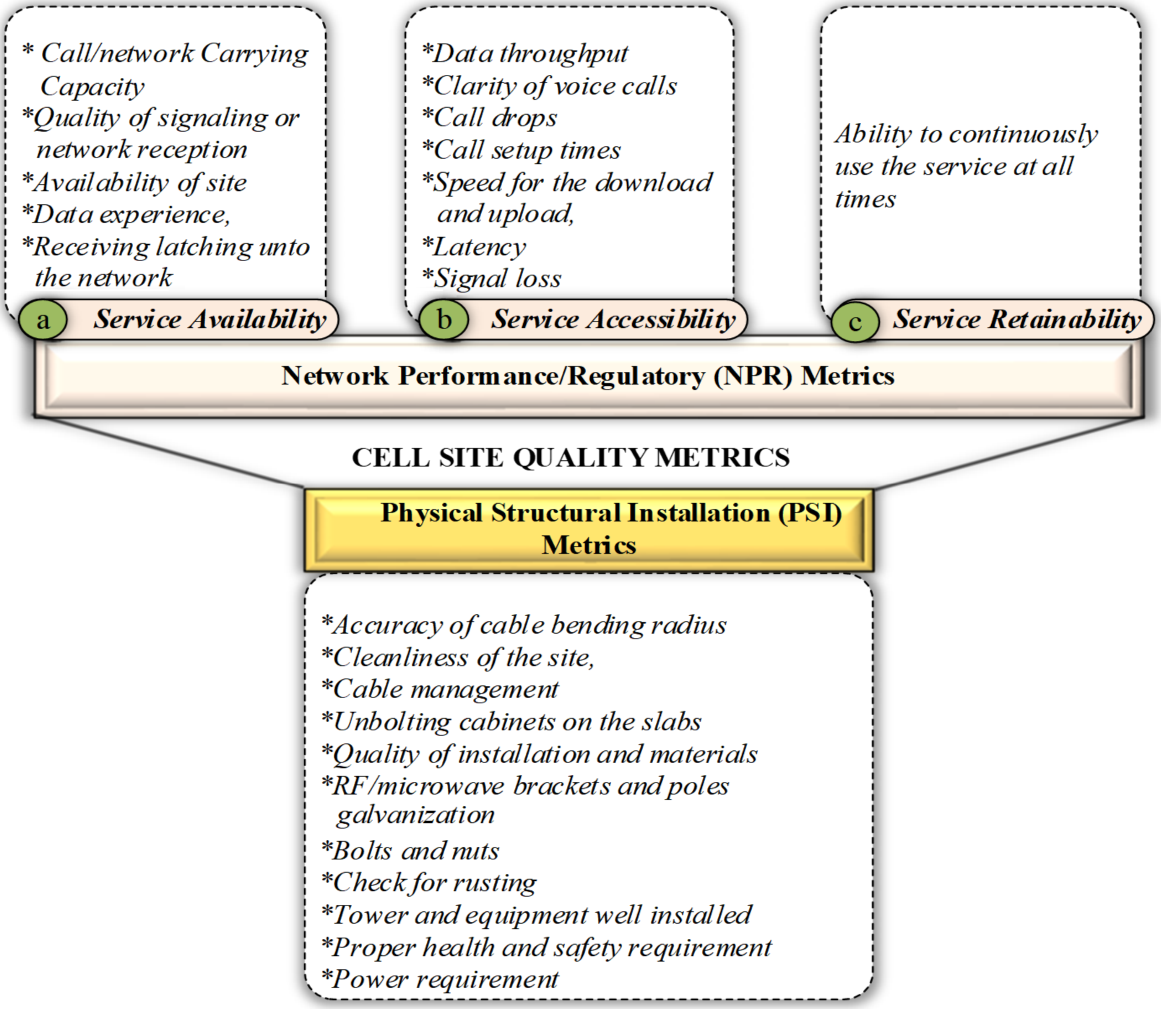


Figure 6.1: Cell site project quality metrics
Source: Researcher's own construct (2020)

Out of scope causal factors

The CFA results show that out of scope is a determinant of value leaks in telecommunication network expansion projects. The finding indicated that out of scope is synonymous for scope creep, thus, the inclusion of unbudgeted project activities which were not part of the initial scope definition. The study further indicated that out of scope usually comes from the contracting operator (telecommunication company), so, a vendor's failure to recognise an additional request by the operator as a change request constitutes out of scope or scope creep.

The study also revealed that the effect of out of scope on a site project increases project cost, impacts quality, and prolongs delivery timeliness, resulting in value loss. The value leaks integrated factors found from the CFA relating to out of scope are discussed below:

- *Unclear scope requirements:* there are quite a number of parties to a site project, so sometimes gathering requirements from these parties is seen to produce ambiguity in the scope of work for the contracting party. Therefore, this finding is consistent with a previous study by Taherdoost and Keshavarzsaleh (2016) that unclear scope requirements can bring about out of scope, which from this study, resulted in value leaks.
- *Issue with top management support:* the business relationship between the contracting operator and executing vendor makes it easy for most of out-of-scope requests to slip into the project execution. This attitude can only be stopped by top management supporting these parties in the project. However, sometimes due to the execution vendor fearing that they may lose a contractual agreement, as found in the study, the project team of the contracting operator (telco) is seen to take advantage by pushing through undefined activities in the scope of work. This finding is consistent with the findings of some previous studies (Bentil *et al.*, 2017; Taherdoost & Keshavarzsaleh, 2016; Al Zadjali *et al.*, 2014; Ameh *et al.*, 2010).
- *Lack of detailed scope:* the project team is seen as being too conversant with the cell site project to the extent that the scope of work is usually not detailed enough to capture all the needed KPIs. This finding validates the study by Taherdoost and Keshavarzsaleh (2016), which indicated that lack of detailed scope brings about out of scope activities, resulting in value leaks.

6.3.2 Research question 2:

To what extent do value leaks' causal factors impact project performance?

The objective of question 2 sought to quantitatively examine the impact of the identified value leaks' factors on project performance. The findings of the aggregated percentage analysis resulting from the CFA second-order measurement model and the amount established quantitatively, as the value that leaked during network expansion, is illustrated in Figure 6.2 and further elaborated on.

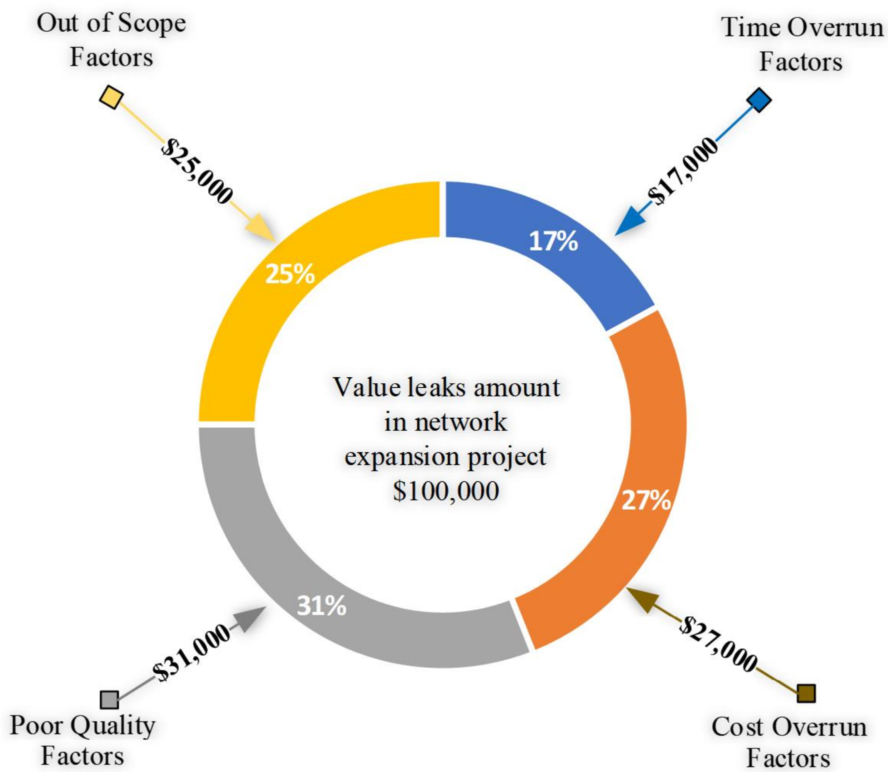


Figure 6.2: Value leaks causal factors impact on project performance

Source: Researcher's own construct (2020)

From Figure 6.2, the study contends that establishing the amount of value leaks during project deployment and integrating poor quality, cost overrun, time overrun, and out of scope to assess the impacts on project performance, is a new addition to advanced knowledge in the field of project management.

This argument is based on observations in the literature that no empirical work has been found that focused on the occurrence of value leaks in project management. Some previous research works, however, focused on the individual measures separately without integrating all four in the same study to assess their impact on project performance, as done in the current study and summarised below:

- The findings reveal that poor quality causal factors have the highest impact of 31%, constituting $31 000 out of a value leak amount of $100 000. This finding is inconsistent with the study of Love *et al.* (2002), where the authors after sampling 161 projects, concluded that poor quality resulting from both direct and indirect rework costs, constituted 12%. The current study argues that poor quality, which has the highest impact on project performance, is too important for it to be ignored by EVA in the assessment and reporting of project performance. The finding, therefore, advances the debate on quality inclusion in EVA as a measure of project performance which is different from previous studies on EVA's extensions (Cândido *et al.*, 2014; Pedro *et al.*, 2011; Noori *et al.*, 2008; Corovic, 2007; Howes, 2000). Also, the study proposes that the occurrence of poor quality and its associated loss amount should be included in EVA as value leaks in assessing and reporting project performance.

- The findings indicate that cost overrun factors at 27%, are the next highest impacting factors, contributing $27 000 to the occurrence of $100 000 value leaks' amount. This finding is inconsistent with the study of Danso and Antwi (2012), who qualitatively, found site projects delay in just one telecommunication company as a 50% increase on project budget, nevertheless, they could not establish the actual value loss as was done in this study. In view of this finding, this study argues that the amount of value lost via cost overrun cannot just be seen as a cost variance in EVA whilst reporting project performance, as asserted by previous scholars (Janeska *et al.*, 2016; Wyrozębski & Łysik, 2013). Instead, it should be recognised as value leaks during assessing and reporting on project performance. This finding further supports the study's justification for advocating for the inclusion of value leaks into EVA, which is the technique most often used to assess and report project performance in the telecommunication industry.
- The out of scope factors follow that of cost overrun with an impact factor of 25%, constituting $25 000 to the occurrence of the value leaks amount. Although EVA reports on deviations in project time and cost, it does not report scope changes or additions to scope, as affirmed by Howes' (2000) study where he outlined the limitations of EVA. Therefore, the current study contests that the out of scope factors found are the solutions to EVA's inability to report on scope additions within the context of network expansion projects in the telecommunication industry. Also, the impact of out of scope should be quantified in terms of value loss, and reported as leaks within EVA in the assessment of project performance. The current study concludes that this finding is a new addition to the existing knowledge, as it extends EVA and advances its argument in the assessment of project performance.

Besides, no such research is seen to have quantified the impacting factors for out of scope on project performance and its associated value loss in project deployment.

- Lastly, time overrun factors at 17% have the least impact on project performance, contributing $17 000 to the occurrence of an amount of $100 000 value leaks. In the assessment of project performance with EVA, the occurrence of time overrun is reported as a deviation in the timeline, as asserted by the PMI (2013), DOE (2008), and Vanhoucke and Vandevoorde (2006). In view of this, the study contends that such an occurrence should not only be considered as a deviation but rather recognised as value leaks, and a determination of its accompanied value loss amount should be part of EVA's calculation, and it should be reported as such. This finding is also in discord with the study by Danso and Antwi (2012), where they concluded that project delays fall between 35% and 55% but could not ascertain the value loss that project delays brought to the delivery of project value.

6.3.3 Research objective 3:

How do the different sources of value leaks (stakeholders, project life cycle, and environment) impact project success?

The objective of question 3 sought to explore the impact of the various sources of value leaks (stakeholders, project life cycle, and environment) on project success. Three statistical hypotheses were formulated from the findings of the case study in Phase 1 of the study. In view of this, the statistical significance of the structural parameter values was evaluated to test and validate the hypotheses. With the use of SEM analysis, the findings from the structural coefficients are summarised in Table 6.1, and subsequently discusses.

Table 6.1: Summary of research hypotheses

List	Hypothesis	Remarks
Hypothesis 1	H_1: The project stakeholder is a source of value leaks because its causal factors have a strong negative relationship with project success.	Supported
Hypothesis 2	H_2: The project environment is a source of value leaks because its causal factors have a strong negative relationship with project success.	Supported
Hypothesis 3	H_3: The project life cycle is a source of value leaks because its causal factors have a strong negative relationship with project success.	Not Supported

Source: Researcher's own construct from field data (2020)

6.3.3.1 Hypothesis 1: Project stakeholders

The findings reveal that the path that links the project stakeholder to project success produced a negative significant coefficient value. Therefore, the negative direction supports the hypothesis that the project stakeholder is a source of value leaks during project deployment. The establishment of the project stakeholder, especially quantitatively, as a source of value leaks is a new addition to project management knowledge, because perceivably, no previous research was found in that regard in the literature.

However, arguably, this finding may support the PMI's (2013) assertion that the power and interest of the project stakeholders ultimately determine whether a project will succeed or not. Similarly, AlSehaimi *et al.*'s (2013) argument that project overruns originate from the actions and inactions of the project team executing the project can be justified by this finding. Affirmatively, this finding contends that the project stakeholder is a source from where certain factors emanate to cause value leaks during network expansion projects.

From the study, a project stakeholder is defined as anyone with a vested interest that has a direct bearing on the outcome of the project activities. The project stakeholders are classified into internal and external stakeholders. The individuals found as internal stakeholders include the project team, sponsor (CEO), functional units, board of directors. External stakeholders involve opinion leaders, landlords, managed service team, vendors, government and regulatory agencies.

6.3.3.2 Hypothesis 2: Project environment

The findings from the SEM analysis indicate that the path that connects the project environment to project success yielded a negative significant coefficient value, which supports the hypothesis that the project environment is a source of value leaks during project deployment. Similar to the project stakeholder, the project environment as a source of value leaks is seen as a new addition to project management knowledge, because noticeably, it has not previously been established, especially quantitatively, in the field of project management. However, this finding can be contended as supporting the arguments put forward by Simushi (2017) and Ludovico and Petrarca (2010) that the project environmental factors can improve, or negatively or positively impact the outcome of projects.

As additional information from the study, the project environment is defined as the elements that could influence the success of the project activities at the location where it is being carried out.

This study identified three key environments found to impact project success during deployment: firstly, the physical environment (social), that is, the behaviour of all the people and their locations involved in the project. Secondly, the financial environment (economical), that is, the financial conditions surrounding the project, and thirdly, the regulatory environment (government), thus, the governmental and regulatory agencies' policies and procedures governing the rolling out of a site project. Broadly, this physical environment (social) is termed as the internal environment of the contracting company, while both the financial and regulatory classifications are termed as the external environment of the contracting company.

6.3.3.3 Hypothesis 3: Project life cycle

The SEM results reveal that the path that links the project life cycle to project success produced a positive coefficient value, which does not support the hypothesis that the project life cycle is a source of value leaks during project deployment. This finding is evidence that the project life cycle is rather a wheel on which a project is delivered successfully to achieve its value, rather than being a source of value leaks.

This finding confirms the assertion that the project life cycle is the process of turning organisational vision into reality (Turner, 2009). However, it contradicts the initial deduction made from this assertion in the process of turning organisational vision into reality that there are some factors which can hinder the success of it.

6.4 RESEARCH AIM ACHIEVEMENT

The overall aim of the study was to develop a diagnostic model that aids in the easy identification, control and remedy of value leaks to minimise the forgone, unrealised project value in the context of telecommunication network expansion projects.

Prior to achieving this overall aim, the study theorised the concept of value leaks based on the findings from Objectives 1, 2, and 3 to solidify the development of the diagnostic model as explained below.

6.4.1 Theorisation of value leaks concept during network expansion project deployment

The current emphasis on value creation has made project value a vital topic of debate in project studies (Martinsuo, 2020). Supporting this view, Green and Sergeeva (2019) asserted that the emergence of the value-creation theme from the paradigm shift requires the recognition of different kinds of value and new models of value creation which go beyond project completion.

Therefore, in speculating beyond the current thinking regarding value creation in the form of project outcomes based on the findings, the study theorises the concept of value leaks, and reifies it during project deployment to appraise the overall project value in the form of the outcomes stated in the business case, as alluded to by Keen (2011).

Figure 6.3 theorises that value leak is simply an opportunity cost of not finishing on time, within budget, scope and quality metrics, supporting Turner's (2009) value linkage assertion. Similarly, the PMI (2017) asserted that poorly managed projects lead to missed deadlines, cost overruns, poor quality and rework, as well as uncontrolled expansion of the project. In view of this, value leaks can also be termed as the consequence of the poor management of projects.

The findings, as illustrated in Figure 6.3, also indicate that telecommunication companies sometimes experience the occurrence of value leaks during project deployment. The amount of project budget that the quantitative study identified as constituting value leaks during deployment amounts to approximately US$100,000, which resulted from delays, reworks, and so forth. This is an extremely large amount of money to lose, considering the economic and social contributions of these projects in the telecommunication industry (GCT, 2019, Ghana Statistical Service, 2014).

However, to establish the real value achieved through projects, such occurrences need to be estimated as part of the outcome. Although, the traditional project management literature abounds with studies on time, cost, scope and quality as success measuring criteria (Jugdev & Muller, 2005; Baccarini, 1999; Pinto & Mantel, 1990; Pinto & Stevin, 1988), none has ever considered such occurrences as value leaks, both before and after the paradigm shift.

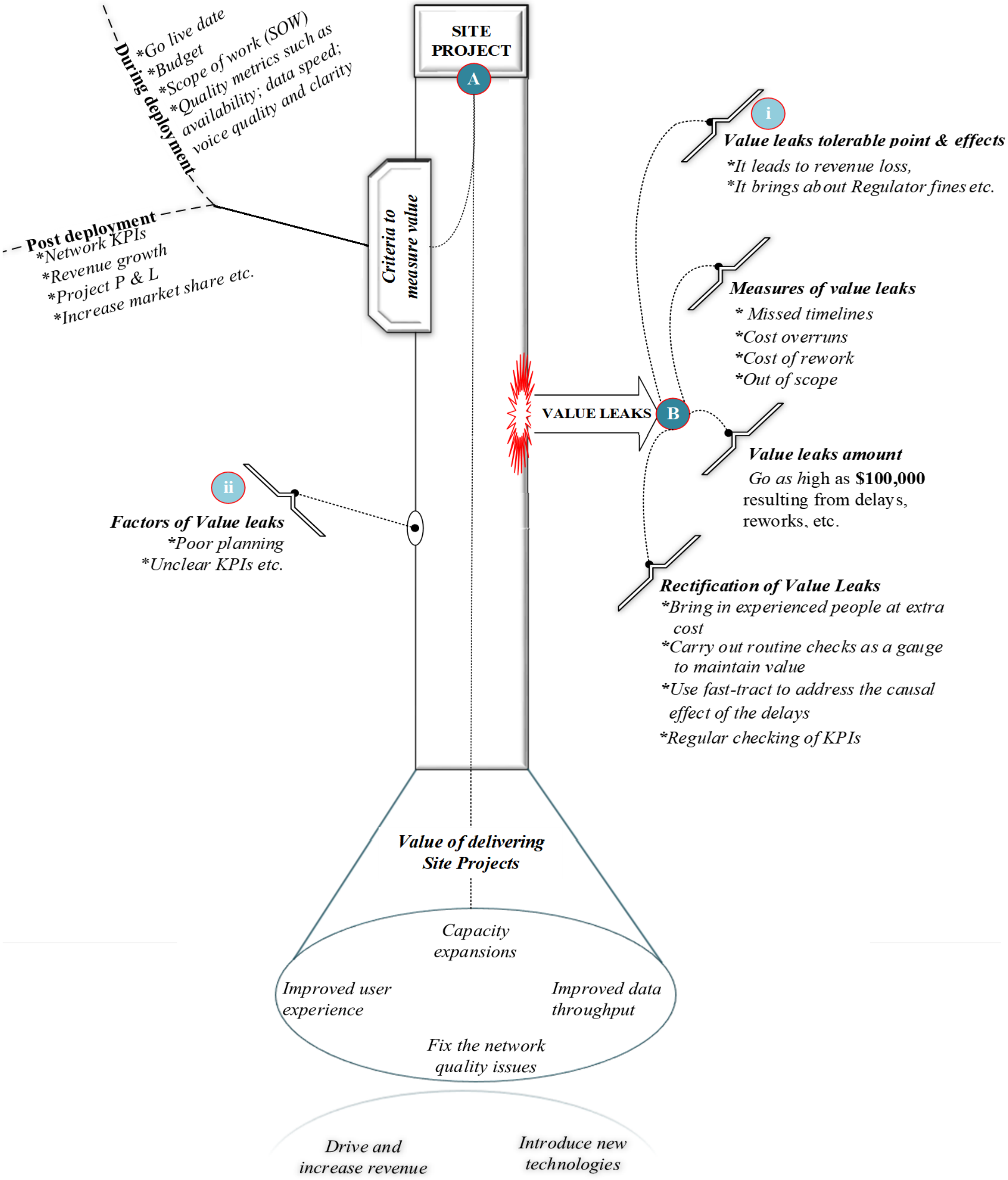


Figure 6.3: Value Leaks Flashlight

Source: Researcher's own construct (2020)

Furthermore, the inability to realise value from projects points to a lack of understanding of the consequences of value leaks (Keen, 2011). In this regard, Figure 6.4, that is an add-on to Figure 6.3, posits that the delivery of the project's desired value through the value-creation process has a budget designated for the phases of the project. The phases of the project are seen to have a control account with work packages that aggregate the scope of work, with quality metrics, schedule (time) and budget (cost) to assess the earned value (PMI, 2017).

The value-creation process has a start date and expected value delivery date. During this value-creation process, value leaks may occur when the work package cost goes over the estimated and authorised baseline (cost overrun), timeliness is missed (time overrun), rework is necessary due to poor quality, and resources are spent on unplanned activities (scope creep), which are also considered as a poorly managed project (PMI, 2017).

The occurrence of less than two weeks' delay, rework due to poor quality, and having to execute unplanned activities with no extra monetary resources being supplied to complete the project work is considered as the value leaks' tolerable point, as illustrated in Figure 6.4.

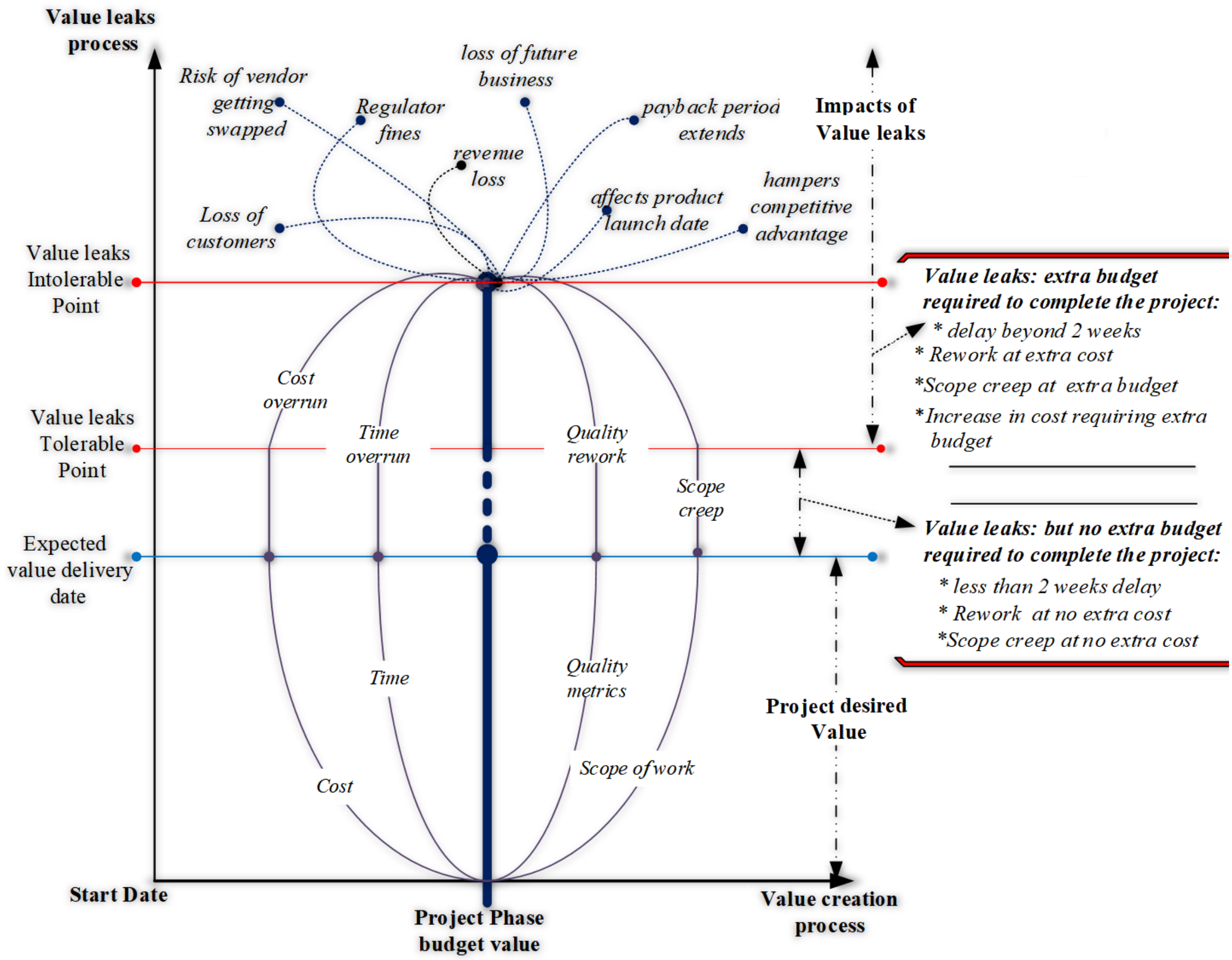


Figure 6.4: Value Leaks Tolerable Nut

Source: Researcher's own construct (2020)

However, as exhibited in Figure 6.4, an aggregation of the estimated costs of the work packages culminate in an approved cost baseline. The cost overruns only fall in the value leaks' intolerable point in the process. This, therefore, reifies that an occurrence of value leaks should be quantified in monetary (cost) terms with regards to time overrun, rework due to poor quality, and out of scope occurrence. Nevertheless, the aforesaid, which necessitate extra monetary resources to complete the work package, constitute the value leaks' intolerable point.

This, therefore, becomes problematic and its resulting effects are that the product launch date is delayed, resulting in losses for both potential and existing customers. Also, the value of gaining a competitive advantage is hampered, as well as losing out on the revenue opportunity stated in the business case extending the payback period. In addition, value leaks can lead to a loss of future business, where a contracting vendor could be replaced by a competitor. Also, it can bring about regulatory fines which can potentially erode the image of the network operator as a non-consumer-centric entity, and at the extreme, it can result in the death of members of the project team.

Finally, as previously explained extensively, the study found 12 integrated factors under the following four measures:

- **time overrun:** poor planning, labour disputes, landlord's refusal to sign a contract for leasing of the land;
- **cost overrun:** poor communication skills, inadequate planning and scheduling, inaccurate time and cost estimate;
- **poor quality:** changing quality needs during project implementation, unclear KPIs, lack of quality focus; and
- **out of scope**: unclear scope requirement, issue with top management support, and lack of detailed scope.

These factors were found to originate from the project stakeholders and project environment. The understanding of how value leaks can be rectified can ensue value in the delivery of projects (Keen, 2011).

In this regard, Figure 6.4 sheds further light on some rectification measures that have been identified to curb the occurrence of value leaks. These include the use of experienced people, even if it costs extra, to deliver the needed value, to ensure that regular routine checks are carried out as a gauge to maintain value, and to carry out regular monitoring exercises related to the required KPIs to avoid any slips.

In effect, the concept of value leaks has now been empirically reified, established and solidified within the field of projects, which might traditionally have been considered as a slip in the company's quest to achieve value through projects. This practical establishment of the concept of value leak cements the development of the Value Leaks Diagnostic Model, which is the achievement of the study's overall aim, as elaborated on below.

6.4.2 Value Leaks Diagnostic Model

The empirical establishment of the concept of value leaks from the findings of Objectives 1, 2, and 3, culminated in the development of the "Value Leaks Diagnostic Model", as illustrated in Figure 6.5. This model is more quantitatively inclined as it has been tested, validated, and confirmed with EFA, CFA and SEM. In view of this, the strength of this model lies much more with explanatory model as the variables have been tested and have statistically significant relationship with value outcome.

This diagnostic model is believed to aid in the easy identification, monitoring and remedy of value leaks to minimise the forgone unrealised project value through an application of the "**CIIR**" acronym. In the model, the "**C**" represents Stage 1: Creation of business value through projects; the first "**I**" signifies Stage 2: Inclusion of value leaks into EVA as a measure of project performance; the second "**I**" denotes Stage 3: Identification of value leaks' causal factors and their sources during deployment; and lastly, the "**R**" epitomises Stage 4: Remedy of the occurrence of value leaks during deployment. The four stages are discussed below.

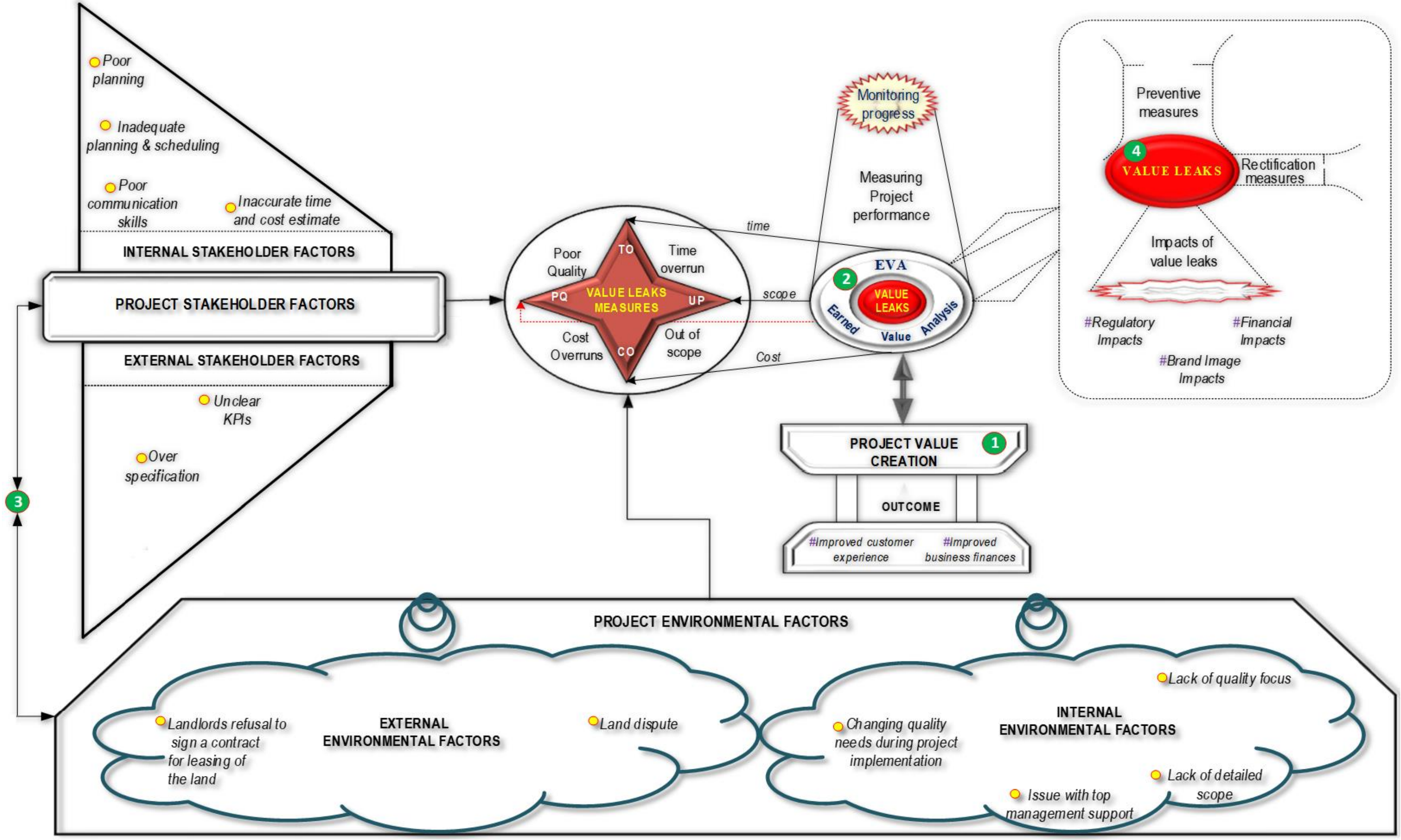


Figure 6.5: Value Leaks Diagnostic Model

Source: Researcher's own construct (2020)

Stage 1: Creation of business value through projects

The first stage of the diagnostic model, as shown in Figure 6.5, posits that the telecommunication sector undertakes network expansion projects in both a greenfield (a completely new location where a tower is built) and brownfield or colocation (an upgrade on an existing site) to achieve two main forms of business value, namely, enhanced customer experience and improved business finances. The former value seeks to provide network access, expand network capacity or fix network quality issues either by regulatory directive or strategic decision. The later value is the resulting effect of the former, which includes revenue growth, improved project profit and loss account, and capture high areas to increase market share. The players in the telecommunication sector are found to make huge investments to be able to achieve the aforementioned values. The resulting effect of such huge investments contributes immensely to economic growth. With regards to this, effort must be made to maintain value throughout the project's value creation process.

Stage 2: Inclusion of value leaks into EVA as a measure of project performance

The second stage of the diagnostic model, as presented in Figure 6.4, postulates that the assessment of project performance in the telecommunication sector is based on four (4) parameters: time, cost, scope, and quality metrics or KPIs. Although all these parameters are important, quality KPIs are the most considered parameter in assessing the value of the delivery of projects.

The EVA technique is applied in the telecommunication sector to monitor project progress, and to assess and report on project performance. However, it is known that EVA excludes quality KPIs in the monitoring of project progress, and rather integrates time, cost and scope to assess and report on project performance. Nonetheless, as project quality metrics are held in high esteem in assessing project performance, it must be included in EVA to measure project performance. In the application of EVA, the narrative in reporting deviations in project performance as a slip mantra should be changed.

The occurrence of missing timelines (time overrun), going over budget (cost overrun), performing undefined and unbudgeted activities (out of scope) and reworking on quality metrics (poor quality) ought to be considered as value leaks, and reported as such in the assessment of project performance through EVA. These are the measures of value leaks that should become perceptible through the application of EVA.

Therefore, such occurrences should be quantified and reported as the part of project value that has gone to waste. This confirms the basis of including value leaks in the application of EVA to measure project performance, as illustrated in the diagnostic model depicted in Figure 6.4.

Stage 3: Identification of value leaks' causal factors and their sources during deployment

The third stage of the diagnostic model, as exhibited in Figure 6.4, depicts that during the project value creation process, certain factors pervasively cause value leaks. In the quest to deliver value, these factors must keenly be identified and monitored to maximise the expected overall business value. These factors originate from two main sources: the project stakeholders and project environment.

The factors from the project stakeholders are grouped into internal stakeholder factors and external stakeholder factors. The internal stakeholder factors are poor planning, inadequate planning and scheduling, inaccurate time and cost estimate and poor communication skills. The external stakeholder factors are unclear KPIs and over-specification. Similarly, the project environmental factors have both internal and external factors. The internal environmental factors are lack of quality focus, changing quality needs during project implementation, issues with top management support, and lack of detailed scope. The external environmental factors are land disputes and landlord's refusal to sign a contract for leasing the land.

These factors and their sources of origin were tested and confirmed as the integrated causal factors that propel the occurrence of value leaks during cell site deployment. Therefore, attention should be given to these factors and their sources throughout the deployment or the value creation process.

Stage 4: Remedy to the occurrence of value leaks during deployment

The last stage of the diagnostic model, as illustrated in Figure 6.4, postulates that failure to maintain value through the creation process results in value leaks. The impacts of value leaks during the creation process are detrimental to the achievement of the overall business value outcome of an enhanced customer experience and improved business finance.

From the study, the findings on the impacts are classified under three (3) broad areas: regulatory impact, brand image impact and financial impact.

- The regulatory impact is seen when the contracting telecommunication company receives a big fine for their failure to adhere to the regulatory directives.
- The brand image impact is the bashing from the network subscribers in the public domain that results from consumers experiencing poor quality issues of service unavailability or inaccessibility, making the contracting company unpopular in the telecommunication space.
- The financial impact is the company's inability to achieve the financial targets set for rolling out the projects such as revenue growth, improved project profit and loss account, and capture high areas to increase market share.

Although the occurrence of value leaks should not be encouraged in the quest to achieve business value, it does sometimes occur during deployment as found in the study, and there is the need to comprehend how it could be rectified. Therefore, to rectify the occurrence of value leaks, the only option may be to appoint experienced people at extra costs to complete the project and to safeguard the overall needed value. Also, regular routine checks through troubleshooting and monitoring exercises related to the required KPIs, must be carried out as a gauge to maintain value and to avoid any leaks. Furthermore, the introduction of overtime payments and adding more project resources based on a commission system could help to facilitate the delivery of the project outcome, although this measure may deepen the value leaks amount in the short while, but in the long run, it helps to deliver overall business value.

6.5 SUMMARY OF RESEARCH ANALYTICAL TECHNIQUES USED TO ACHIEVE THE OBJECTIVES

The summary of research techniques used to achieve the objectives of the study are illustrated in Table 6.2. In view of this, the authors who advocated for the use of specific analytical techniques are referenced and these analytical techniques are briefly explained. Also, how the analytical techniques contributed to the achievement of the specific objectives and questions of the study is elucidated.

Table 6.2: Analytical techniques used to achieve the objectives of the study

References	Analytical techniques	Brief description	Contributions of the analytical techniques to accomplishing the objectives of the study	Objectives and Questions
Guest *et al.* (2012)	Data winnowing	A process of focusing only on the data relevant to the study and discard those of less importance.	In the qualitative phase of the study, the data obtained from the interview process was massive and through data winnowing technique, less important data was discarded and subjected the relevant data to the coding process.	1,3
Novak & Cañas (2006)	Concept mapping	A method of exhibiting and organising ideas using pictures	In the literature review, the study used the idea of concept mapping to formulate the measures of value leaks and develop the conceptual framework to lay foundation for the study. In the qualitative study, the study used concept mapping idea in addition to innovation concept to develop Model-Cages to showcase the interrelation and linkages among the value leaks causal factors across different companies and diagrams to display key elements derived from the narratives of the interviews	1,3
Bryne (2010)	EFA	A technique used to establish how, and to what extent, the observed variables are associated with their underlying factors.	EFA was performed to minimise the set of causal factors found within a given construct (measures and sources of value leaks). The sampling adequacy and reliability of internal consistency ensuing content validity was established for the pursuit of confirmatory factor analysis	1,3
Hair *et al.* (2010)	CFA	A technique to test the validity of the structure from EFA and verify how well the	CFA helped to establish the actual factors that cause value leaks and sources of origin during site project deployment. Quantitatively, CFA statistics helped to determine the impacts of these value leak's causal factors on project performance.	1,2,3
Bryne (2001 and 2010)	SEM	A designed to evaluate how good a proposed conceptual model could fit a set of collected date and examine the structural relationships between the latent variables	Structural model helped to evaluate and validate fitness of the proposed Value Leaks Diagnostic Model. The results of the structural model gives an indication of overall model fit to the dataset as all the fit indices met the recommended thresholds. The statistical significance of the structural parameter values were evaluated to test and validate the hypotheses based on path analysis.	4
Miles *et al.* (2014)	Innovation concept	The researcher should not be limited by the format to display the outcome but innovate what works best for the study.	The study used this idea to innovate the outcome of the study by developing Value-Leaks Flashlight, Value Leaks-Tolerable Nut, and Value Leaks Diagnostic Model; which aids value leaks to easily be identified, monitored, and remedied to minimise the forgone unrealised project value and unplanned utilisation of resources	1,2,3,4

Source: Researcher's own compilation (2020)

6.6 CHAPTER SUMMARY

This chapter proposed a Value Leaks Diagnostic Model that may enhance the achievement of value through the project value-creation process for both the experienced and amateur project practitioners within the context of project management in the telecommunication industry. This diagnostic model is believed to aid in the easy identification, monitoring and remedy of value leaks to minimise the forgone unrealised project value through the application of the "**CIIR**" acronym.

CHAPTER 7:
CONCLUSIONS AND RECOMMENDATIONS

7.1 INTRODUCTION

The ultimate aim of the study was to develop a diagnostic model that can aid in the easy identification, monitoring, and remedy of value leaks to minimise the occurrence of value leaks. This aim was accomplished by addressing specific research objectives: a critical analysis of value leaks' causal factors during project management; to examine quantitatively, the impact of the identified value leaks' factors on the project performance, and to explore the impact of different sources of value leaks (stakeholders, project life cycle, and environment) on project success.

The findings from these objectives culminated in the development of the Value Leaks-Flashlight", with an add-on "Tolerable Nut" to theorise the concept of value leaks within the context of network expansion projects in the telecommunication industry. This practical establishment of the value leak concept cements the development of the value leaks diagnostic model, which fulfils the overall aim of the study.

These models reveal how the telecommunication industry uses network expansion projects to create value, how this value is measured both during and post-deployment, what constitutes a value leak in a practical sense, how value leak becomes evident, and to the extent that the occurrence of value leaks becomes problematic in an organisation's quest to create business value through project deployment. Finally, how such value leaks can be rectified.

Therefore, this chapter presents the conclusions drawn from this empirical research as summarised in Section 1.7.4, followed by the recommendations made based on the findings from the objectives of the study. Subsequently, the chapter concludes with discussions of the limitations encountered in the study and suggestions for future research.

7.2 CONCLUSIONS

As a managerial implication, the concept of value leaks is now reified, established and solidified within the field of projects, which changes the narrative on reporting deviations in project performance, which was traditionally considered as a slip in the company's quest to achieve value through projects. The appreciation of this value leaks concept is believed to help companies, especially within the telecommunication industry in Ghana, to enhance the achievement of their strategic goals of creating value through the successful delivery of their projects.

Also, both experienced and amateur project management practitioners can use the Value Leaks Diagnostic Model as a guide and mechanism to create and maintain value through projects, especially within the telecommunication industry. This diagnostic model aids in the easy identification, monitoring and remedy of value leaks to minimise its occurrence.

The justifications for this statement are that firstly, this diagnostic model has identified 12 factors based on four value leaks measures, which have been found to cause value leaks from two main sources, namely, the project stakeholders and project environment, and these factors must be monitored and controlled keenly to minimise the likelihood of value leaks occurrence. Secondly, with the model, the inclusion of value leaks into EVA is established to monitor progress and report project performance. Thirdly, with the model, some rectification measures are outlined to curb value leaks during project deployment.

In addition to the adoption of the Value Leaks Diagnostic Model, both experienced and amateur project management practitioners may use the Value Leaks-Flashlight to gain an in-depth understanding of how the telecommunication industry uses network expansion projects to create value, and how this value is measured both during and post-deployment, what constitutes a value leak in a practical sense, and how a value leak becomes evident. Again, the Leaks-Tolerable Nut can be utilised to determine the extent to which the occurrence of value leaks becomes problematic in their quest to create business value through project deployment.

Finally, it is apparent that EVA is used by project management practitioners to monitor and report project performance. The measures of value leaks have become perceptible through EVA's application. Therefore, such occurrences should no longer be reported as a slip in the project performance in general, but must be seen as value leaks, which should be quantified and reported as part of project value that has gone to waste.

Theoretically, the principal originality of this study stems from the fact that the debate on value creation has become more prevalent in project literature in recent times, although the issue of value leaks during project deployment has scarcely been addressed. Therefore, this empirical study reified, established and solidified the concept of value leaks during project deployment within the field of project management literature. In view of this, the study contends that this is thought-provoking which may arouse the interest of the academic community for an advanced debate. Furthermore, the study developed the Value Leaks Diagnostic Model, which aids in the easy identification, monitoring and remedy of value leaks to minimise the forgone unrealised project value, as well as the unplanned utilisation of resources, through the application of the "**CIIR**" acronym.

The model again strongly suggests that attention should be paid to the value that leaks, whilst emphasising the creation of overall business value through projects. This information is believed to be a huge contribution to the contemporary literature in the field of project management, as the concept of project value leaks is still gaining prominence and little empirical studies have been conducted. This, therefore, builds on the existing literature for both project management professionals and researchers to expand their knowledge and conduct further research in that regard.

Several studies have been conducted on time and cost overruns in construction projects worldwide, as well as the extension to EVA as a measure of project performance. However, there is no research work perceivably that posits value leaks in the context of project management, specifically, in the EVA technique to measure and judge project performance. This makes the findings from the study can be seen as a contribution of new knowledge in the application of EVA as a measure of project performance at large.

Furthermore, the ingenuity behind the development of the two models: The Value Leaks Diagnostic Model, namely, the Value Leaks Flashlight and the Value Leaks-Tolerable Nut is believed to advance knowledge. In this view, the study makes a substantial contribution to the development of knowledge by encouraging and instilling the sense of creativity in displaying the findings of the study, as arguably, the pictorial representation of research findings endears the attention of the reader by eliminating tediousness.

Methodologically**,** the research design and the methodology specified in the study are believed to serve as a benchmark methodology, which highlights the stages involved to in carrying out a mixed-method study. The emphasis is placed on the procedure specified in the application of EFA, CFA, and SEM of the study which can be used as a yardstick in carrying out similar studies.

Furthermore, both scholars and industry players can use the research instruments developed to carry out a basic pre-test exercise in their studies. The instruments developed in the study are believed to serve as a blueprint to determine the occurrence of value leaks in any industry. Therefore, by benchmarking this blueprint, such studies can easily be carried out. More so, the diagnostic model and other models developed from this study are believed to serve as a benchmark methodology, which can be utilised to ascertain the occurrence of value leaks during project deployment, its impact on project performance and how to remedy it.

Furthermore, the process of the systematic literature review conducted in the study is believed to serve as benchmark methodology, which provides insights into the inclusion of value leaks into the EVA techniques, as a measure of project performance with special focus on network expansion projects in Ghanaian telecommunication industry.

The findings from the systematic literature review further offered insight into theoretical models on causal factors related to time overrun, cost overrun, poor quality and out of scope and their sources.

7.3 RECOMMENDATIONS

This study advocates that project management practitioners ought to reorient their mindset on project management principles. From the study, these practitioners hastened to attribute every action relating a cell site project to their level of experience in mastering the act of deployment. The continuous undertaking of cell site projects should rather congeal their level of experience by facilitating the delivery process, rather than seen downplaying the project management methodology under the pretext of mastering the act.

In the study, the key contributing factors to the occurrence of value leaks include poor planning, and inaccurate time and cost estimates. These factors are found to be associated with poor project management practices. This mindset of mastering the act is perceived to have blindfolded their sense of good judgement on project management application. In view of this, the project management practitioners must embrace the simple principle that every project is unique on its own, and should be treated at such by adhering to the project management methodology of carrying out the initiation activities properly, ensuring proper planning from end-to-end, executing the planned activities to the letter during which these activities must be closely monitored and controlled, and lastly, ensuring the proper handing-over of the project's outcome. This reorientation of their mindsets on the adoption and application of good project management practices could go a long way to minimise the likelihood of the occurrence of value leaks during the project value-creation process.

In addition, the telecommunication companies have the duty to demystify the complexity of cell site projects within the communities where the projects are carried out. The study discovered that labour disputes between the project team and the community, as well as the landlord refusing to sign a contract for leasing of land could prolong the commencement of the cell site project or halt the continuity of the project during implementation beyond the ordinary, under the misconception and fear of community contracting diseases such as cancer.

The complexity of cell site project and its misconceptions could clearly be explained in the form of engagement with the landlords, opinion leaders and the community members through corporate social responsibility (CSRs) activities. As found in the study, there is a high illiteracy rate among these groups of people, so embarking on community engagement in the form of CSRs, provides the contracting company with the opportunity to educate the community on their misconception about the cell site project, whilst also giving back to the community in the form of developmental and social intervention activities.

Furthermore, the project management practitioners ought to convince project stakeholders with effective communication skills. In the study, it was found that factors such as unclear key performance indicators (KPIs), over-specification, poor communication skills, changing quality needs during project implementation and issues with top management support are pervasive in causing value leaks during project value creation process. These factors predominantly reside under the jurisdiction of the project management team. Therefore, the act of gaining full cooperation and commitment from all the project stakeholders by the project team, requires the ability to communicate effectively in the diverse ways that would convince these stakeholders to support the project throughout the implementation process. In this way, KPIs would be clearly identified without any ambiguity, changes in quality needs would be brought to bear, and project decisions could easily be made with top management's sanction without any delay.

Lastly, the study proposes the adoption of project management software by the top management of the companies within the telecommunication industry in Ghana. Noticeably, the management teams rely solely on the weekly updates shared by their respective project management offices. They should have an alternative means of tracking project progress, so that the realisation of the occurrence of value leaks is not delayed. With project management software (enterprise project management, Jira), technology has allowed progress tracking, budget utilisation tracking, resource optimisation, risk assessment and monitoring, the timely and effective performance reporting to become effortless and easy tasks. This would not only give first-hand visibility to the top management but also allow them to be involved in the projects from start to end.

To the project management practitioners, the adoption of this project management software would enable them to perform accurate estimations, proper planning, effective risk assessment, monitoring and controlling, enhanced team collaboration, minute performance reporting, and effective and active internal and external communication. These effortless activities by the software would enable the project management practitioners to significantly minimise the occurrence of value leaks during project deployment.

7.4 LIMITATIONS OF THE STUDY

In view of the limitations, the study used a network expansion project, which is just one of the key projects in the telecommunication industry. As classified by Sherif (2006), the projects in the telecommunication- industry are: infrastructure projects, such as *building of data centres, introduction of new platforms, cell site projects (network expansion projects), enhancement of existing platforms and systems*; product development and promotion projects, such as *developing new products, shooting of television and radio commercials* and lastly, IT-related projects which include *the deployment of new campaign management and billing systems*. Therefore, the study that only focuses on network expansion projects within the context of telecommunication industry in Ghana, restricts the generalisability of the findings to the telecommunication projects in its entirety and may not always be transferable to other service industry and geographies

Also, the study was limited by data-collection method used in the qualitative study. The study used only the interview method and review of project plans as a data-collection technique, which may have limited the profundity of information that would have been obtained for the study. Conceivably, the mobile network operators might have limited the depth of value leaks' information that they provided, specifically as related to the actual amount they lost in their quest to create value through projects by rather choosing to approximate the figures under the pretext of proprietary and confidential policies regulating information dissemination within the telecommunication industry in Ghana.

Adding qualitative observation, archival records and review of project documentation methods would provide swift validation option to the claims made on the subject matter by the project management practitioners without necessarily requiring a future study to confirm it in the telecommunication industry. Lastly, although there may be other forms of value leak measures and their causal factors, the study only addressed the factors that cause time overrun, cost overrun, out of scope, and poor quality (rework) as constituting value leaks.

7.5 AREAS FOR FUTURE RESEARCH

In view of the aforementioned limitations, future studies may focus on value leaks in telecommunication projects in general, to establish the generalisability of the findings in its entirety. In addition, future studies can test the Value Leak Diagnostic Model in other industries that are prone to the occurrence of value leaks, such as the building and construction sector. Furthermore, future studies can combine observation, review of documents, and the interview methods to validate the depth of information and assess the outcome of the qualitative study.

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APPENDICES

APPENDIX 1:
ETHICAL CLEARANCE CERTIFICATE

COLLEGE OF ECONOMIC AND MANAGEMENT SCIENCES
DEPARTMENTAL ETHICS REVIEW COMMITTEE
OPERATIONS MANAGEMENT

Date: 25 January 2019

NHREC Registration # : (if applicable)
ERC Reference # : OPS/2019/001

Name : Ernest Marfo Asiedu

Student #: 58551301

Dear Mr EM Asiedu

Decision: Ethics Approval from 25 January 2019 until 25 January 2024

Researcher(s): Ernest Marfo Asiedu
Department of Operations Management
College of CEMS
Email address: 58551301@mylife.unisa.ac.za or
Ernasiedu2006@yahoo.com

Supervisor: Prof Marcia Mkansi
Department of Operations Management
CEMS
E-mail Address: mkansm@unisa.ac.za
Tel number: 012 429 2339

An inclusion of Value Leaks into Earned Value Analysis (EVA) as a measure of Project Performance

Qualification: DPEMS02

Thank you for the application for research ethics clearance by the Unisa Department of Operations Management Ethics Review Committee for the above mentioned research. Ethics approval is granted for 5 years (**see period mentioned above**).

*The **low risk application** was **reviewed** by the Department of Operations Management:*

The proposed research may now commence with the provisions that:

1. The researcher(s) will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.

2. Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study should be communicated in writing to the Department of Operations Management Ethics Review Committee.
3. The researcher(s) will conduct the study according to the methods and procedures set out in the approved application.
4. Any changes that can affect the study-related risks for the research participants, particularly in terms of assurances made with regards to the protection of participants' privacy and the confidentiality of the data, should be reported to the Committee in writing, accompanied by a progress report.
5. Final measuring tool to be submitted to the Departmental Ethics Committee prior to data collection.

Note:
The reference number ERC Reference number OPS/2019/001 should be clearly indicated on all forms of communication with the intended research participants, as well as with the Committee.

Yours sincerely,

Signature
Ethics Chair : Department : Operations Management
E-mail: vanans@unisa.ac.za
Tel: (012) 429 4988

Signature
Executive Dean : CEMS
E-mail: mogalmt@unisa.ac.za
Tel: (012) 4294805

UNISA Correspondence

mandd@unisa.ac.za

Fri 05/01/2018 09:30

To:Ernest Marfo Asiedu <58551301@mylifeunisaac.onmicrosoft.com>;

UNISA university of south africa

A I R M A I L

ASIEDU E M MR

PRIVATE BAG, TUC,
MILLICOM GHANA LIMITED
ACCRA, GHANA
GHANA

STUDENT NUMBER : 5855-130-1
ENQUIRIES :
mandd@unisa.ac.za

FAX : (012) 429-4150

2018-01-05

Dear Student

I have pleasure in informing you that your research proposal has been approved. Please register and pay online for the research component of the degree for the 2018 academic year. Registration for 2018 will open on 3 January 2018 and will close on 30 March 2018. Please refer to the Unisa website: www.unisa.ac.za/studentfunding if you are interested in applying for a postgraduate bursary.

Yours faithfully

for Registrar (Acting)

APPENDIX 2:
INTERVIEW PERMISSION LETTERS AND INTERVIEW GUIDE

Millicom Place, Barnes Road,
PMB-TUC, Accra
Ghana.
Tel: +233 277 555 888.

airtel | tigo

1st October, 2018

Mr. Ernest Marfo Asiedu
+233277551978
58551301@mylife.unisa.ac.za
Accra, Ghana

RE: PERMISSION TO CONDUCT RESEARCH ON NETWORK EXPANSION PROJECTS (CELL SITES ROLLOUT)

Reference to your email and our discussion regarding the research study on AirtelTigo as well as Helios Towers and American Tower Company.

This is to inform you that permission has been granted to your request to carry out your PhD research project on **"An inclusion of value leaks into Earned Value Analysis (EVA) as a measure of project performance'** which seeks to:

- Analyse value leaks' causal factors during network expansion projects management;
- Examine the impact of the identified value leaks' factors on the networks expansion project performance;
- Develop a diagnostic model (conceptual framework) of value leaks during network expansion projects implementation in the context of telecom construction projects.

I wish you the very best in your research.

Yours Sincerely,

AIRTELTIGO

AIRTELTIGO

Joseph Koranteng
Director, PMO
Joseph.Koranteng@airteltigo.com.gh

HUAWEI

Huawei Technologies (Ghana) S.A. Ltd.

No. 60 Rangoon Lane. Cantonments
P. O. Box CT 5803
Accra, Ghana

6th November, 2018

Mr. Ernest Marfo Asiedu
+233277551978
58551301@mylife.unisa.ac.za

RE: PERMISSION TO CONDUCT RESEARCH ON CELL SITES ROLLOUT PROJECTS AT HUAWEI TECHNOLOGIES

This is to inform you that permission has been granted to your request to carry out your PhD research project on **"An inclusion of value leaks into Earned Value Analysis (EVA) as a measure of project performance'** which seeks to develop a diagnostic model that aids value leaks to easily be identified, controlled, and remedied to minimize the forgone unrealized project value as well as unplanned utilization of resources.

With respect to your information sheet, staff participating in this study is voluntary and they are under no obligation to consent to participation. Huawei Technologies and its staff participating in this study will be protected from all forms of identification and a pseudonym will be used for thier names. Every information given will be kept confidential. In a case of a breach of these commitment, Huawei Technologies reserves the right to prevent the publication of the study in the public domain.

We will ensure the provision of your requested which includes the list of potential participants, and their contacts. However, we will need a copy of the research findings for record keeping at the end of the study and we hope the outcome of your study improves our project management process at Huawei Technologies.

All the best in your research.

Kind Regards,

Mr. Zhangwei 张伟 Zhang Wei
Key Account Manager
Huawei Technologies (Ghana) S.A. LTD
60 Rangoon Lane, Cantonments City
Cantonments, Accra

HUAWEI: ENRICH LIVES THROUGH COMMUNICATION
www.huawei.com

RE: PERMISSION TO CONDUCT RESEARCH ON NETWORK EXPANSION PROJECTS (CELL SITES ROLL-OUT)

Aryeh, Jonas, Vodafone Ghana <Jonas.Aryeh@vodafone.com>

Thu 18/10/2018 11:11

To: Ernest Marfo Asiedu <58551301@mylife.unisa.ac.za>;

Cc: ernasiedu2006@yahoo.com <ernasiedu2006@yahoo.com>; Wasiu Yusuf <Wasiu.Yusuf@airteltigo.com.gh>; marcia.mkansi@gmail.com <marcia.mkansi@gmail.com>; Mkansi, Marcia <mkansm@unisa.ac.za>; Aboagye, Shirley, Vodafone Ghana <shirley.aboagye1@vodafone.com>; Salifu, Bashiru, Vodafone Ghana <bashiru.salifu@vodafone.com>;

Hello Ernest,

We are fine to proceed with this request. Kindly note this is subject to review of the questionnaire being used.

Best Regards.

Jonas Samuel Aryeh
Business Risk and Continuity Specialist
External Affairs
jonas.aryeh@vodafone.com

Vodafone Ghana, South Liberation Link
Manet Tower A, Airport City, Accra-Ghana
vodafone.com.gh

The future is exciting.
Ready?

INTERVIEW GUIDE

Dear Sir/madam,

PhD student request for interview

Thank you for taking time to participate in this research. This interview session is part of a larger study by Mr. Ernest Marfo Asiedu, a PhD student of Business Management in the Department of Operations Management, under Supervision of Prof. Marcia Mkansi at the University of South Africa.

The overall aim of the study is to develop a diagnostic model that aids value leaks to easily be identified, controlled, and remedied to minimise the forgone unrealised project value as well as unplanned utilisation of resources. The expected outcome of this study would help companies and project management practitioners within the telecommunication industry especially within the context of Ghana to enhance the achievement of their strategic goals through successful delivery of their projects.

The study seeks to ask questions, and I encourage you to express your views and insights accordingly. This interview should take not more than 60 minutes and you may withdraw at any point in time without any consequences of any kind. The discussion will be tape recorded as well as notes-taken with your consent for accuracy of information and validity purposes. The University of South Africa conforms to relevant data protection legislations and your details will not be disclosed to anyone. All information provided shall be treated with utmost confidentiality and you will be protected from all forms of identification at both personal and at institutional level. I request you to be comfortable and answer the questions as sincerely as possible.

I will be grateful to receive your help and I will give you a phone call to discuss the convenient time and venue later.

Thank you for your time. I look forward to hearing from you

Mr. Ernest Marfo Asiedu

PhD student – Department of Operations Management, School of Public & Operations Management, University of South Africa (UNISA)

Tel: +233277551978: email: 58551301@mylife.unisa.ac.za

Educational and Employment background

The following questions are designed to understand the demographical details of the informants.

1. Kindly let me know your age
2. Please indicate your position in this Company
3. How long have you been with this company?
4. How long have you worked in this position?
5. Apart from this position, which other positions have you worked in?
6. What is your highest level of education and the field of study?
7. What role do you play in Cell Sites rollout project?

Value of delivering Cell Site Project

The following questions are intended to understand the value of rollout out Cell site projects:

1. How would you describe the value of rolling out Cell site project?
2. Describe the criteria you use to measure the value of delivery site projects?
3. How would you describe the duration a Cell Site rollout project must be completed?
4. How would you describe the costs involved to rollout a cell site?

Value Leaks in Cell Site Project

The following questions are intended to appreciate Value Leaks in Cell Site rollout project:

1. How would you describe the value of delivering Cell Sites rollout projects?
2. How would you describe the technique (s) used to measure the value of delivering Cell Sites projects?
3. To what extent do you consider value leak during Cell Sites rollout project?
    a. Estimate the amount of value that leaks during Cell Sites rollout project
    b. Describe the extent to which value leaks become problematic in delivery site project
    c. Describe how often does value leaks occur in Cell Sites rollout project
    d. Describe how value leaks affect delivering of Cell Sites rollout project
    e. Describe how such occurrence are rectified

Earned Value Analysis (EVA) as a Measure of Project Performance

The following questions seek to comprehend earned value analysis (EVA) as a measure of project performance:

1. How would you describe earned value analysis (EVA) as a measure of project performance?
2. How would you describe the situation whereby the amount of work done (earned value, EV) is less than the actual cost (AC) planned for that same amount of work? Thus; EV< AC
3. How would you describe the situation whereby the amount of work done (earned value, EV) exceeded the planned duration for that same amount of work? Thus; EV > PV

Sources of Value Leaks in Cell Site Rollout Projects

The following questions seek to comprehend earned value analysis (EVA) as a measure of project performance:

1. How would you describe Cell Site rollout project stakeholders?
    a. How would you outline these stakeholders from both internal and external of the company?
    b. How would you describe project stakeholders as a source for value leaks during Cell Site rollout project?
2. How would you describe project environment?
    a. How would you outline these stakeholders from both internal and external of the company?
    b. How would you describe the factors considered as or constituents or project environment?
    c. How would you describe project environment as a source for value to go unrealised during Cell Site rollout projects?
3. How would you describe project life cycle?
    a. How would you outline the phases of project life cycle in company?
    b. How would you describe the phase (s) that effect project performance?
    c. How would you describe project life cycle as a source for value to go unrealised during Cell Site Network expansion projects?

Factors that cause Value Leaks in Cell Site rollout project

A). PROJECT DELAYS (Time Overruns)

1. How would you describe project time overruns?
2. Outline the factors that cause cell site rollout projects to delay
3. Please indicate whether these causal factors emanate or come from ***Project Environment, Project Stakeholders, or Project life cycle***

#	Time Overrun Causal Factors	Sources of the Causal Factors
1		
2		
3		

B). OVER BUDGET (Cost Overruns)

1. How would you describe project cost overruns?
2. Outline the factors that cause cell site rollout projects to go over budget
3. Please indicate whether these causal factors emanate or come from ***Project Environment, Project Stakeholders, or Project life cycle***

#	Cost Overrun Causal Factors	Sources of the Causal Factors
1		
2		
3		

C). POOR QUALITY

1. How would you describe project poor quality?
2. Outline the factors that cause poor quality in cell site rollout projects
3. Please indicate whether these causal factors emanate or come from ***Project Environment, Project Stakeholders, or Project life cycle***

#	Poor Quality Causal Factors	Sources of the Causal Factors
1		
2		
3		

D). OUT OF SCOPE (Not meeting project requirements)

1. How would you describe project not meeting project requirements?
2. Outline the factors that cause cell site rollout project not meeting projects
3. Please indicate whether these causal factors emanate or come from ***Project Environment, Project Stakeholders, or Project life cycle***

#	Out of Scope Causal Factors	Sources of the Causal Factors
1		
2		
3		

E). PROJECT TEAM DISSATISFACTION

1. How would you describe project not meeting project requirements?
2. Outline the factors that cause project team dissatisfaction in cell site rollout project
3. Please indicate whether these causal factors emanate or come from ***Project Environment, Project Stakeholders, or Project life cycle***

#	Project Team Dissatisfaction Causal Factors	Sources of the Causal Factors
1		
2		
3		

Thank you for your participation

APPENDIX 3:
SURVEY QUESTIONNAIRE

Dear Sir/Madam,

PhD REQUEST TO PARTICIPATE IN A SURVEY

In furtherance of our earlier interview meeting agreement, I would be delighted if you could make time in the midst of your busy schedule to complete this survey on the topic: "**An inclusion of Value Leaks into Earned Value Analysis (EVA) as a Measure of Project Performance".**

The overall aim of the study is to develop a diagnostic model that aids value leaks to easily be identified, controlled, and remedied to minimise the forgone unrealised project value as well as unplanned utilisation of resources. The expected outcome of this study would help companies and project management practitioners within the telecommunication industry especially within the context of Ghana to enhance the achievement of their strategic goals through successful delivery of their projects.

The survey is expected to take a maximum of 45 minutes to complete. The University of South Africa conforms to relevant data protection legislations and your details will not be disclosed to anyone. All information provided shall be treated with utmost confidentiality and you will be protected from all forms of identification at both personal and at institutional level. Let me also reiterate that permission has been sought from the UNISA Ethical Review Committee with a reference number: OPS/2019/001, to undertake this study within your company, I therefore request you to answer the questions as sincerely as possible. If you would like to be informed of the final research findings, please contact myself, Ernest Marfo Asiedu on +233277551978. Alternatively, you may email me on 58551301@mylife.unisa.ac.za. Should you require any further information about any aspect of this study, please contact my supervisor, Prof. Marcia Mkansi on +27849010362 as well as mkansm@unisa.ac.za.

Thank you for your time. I look forward to hearing from you.

Ernest Marfo Asiedu

(Researcher)

SECTION A: EDUCATIONAL AND EMPLOYMENT BACKGROUND

The section intends to understand the demographical details of the participants. Please **mark** (**X**) on the number that best reflects your agreement with the following.

1. Gender

Male	Female
1	2

2. Age bracket

20 - 25 years	26-31 years	32-37 years	38-43 years	44 years and above
1	2	3	4	5

3. Highest level of qualification

Certificate	Diploma	Bachelor	Masters	PhD
1	2	3	4	5

4. Please indicate whether you have professional training

Professional training in Telecommunication	Yes	No
Professional training in Project Management	Yes	No

5. Position in your Company

Executive	Manager	Unit Head	Director	Chief and beyond
1	2	3	4	5

6. Number of years you have worked with your company

Less than 2 years	2-4 years	5-7 years	8-10 years	above 10 years
1	2	3	4	5

7. Role you play in Cell site rollout

Project Team Member	Project Manager	Rollout Engineer	Planning & Optimisation	Project Director
1	2	3	4	5

SECTION B: CELL SITES DEPLOYMENT BASIC INFORMATION

Please **mark** (**X**) on the number that reflects your agreement with each statement below on cell sites basic information. Rate as follows: **1**= Strongly disagree, **2** = Disagree, **3** = Neutral, **4** = Agree, and **5** = Strongly agree

B1: THE PURPOSE OF UNDERTAKING CELL SITES ROLLOUT AS A COMPANY

#	Why do you rollout cell sites?	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
SC01	Increase coverage	5	4	3	2	1
SC02	Enhance customer experience	5	4	3	2	1
SC03	Meet regulatory requirements	5	4	3	2	1
SC04	Avoid regulatory fines	5	4	3	2	1
SC05	Introduce new technologies	5	4	3	2	1
SC06	Upgrades and enhancements/optimisations	5	4	3	2	1
SC07	Better network capacity	5	4	3	2	1
SC08	Resolve network congestions	5	4	3	2	1
SC09	Improve voice quality and data access	5	4	3	2	1
SC10	Introduce mobile coverage to green field	5	4	3	2	1
SC11	Reduce congestion	5	4	3	2	1
SC12	Capacity expansions	5	4	3	2	1
SC13	Improve data throughput	5	4	3	2	1
SC14	Improved user experience	5	4	3	2	1
SC15	Grow business	5	4	3	2	1
SC16	Meet business case forecast	5	4	3	2	1
SC17	Increase mobile penetration (increase customers)	5	4	3	2	1
SC18	Drive and increase revenue	5	4	3	2	1
SC19	Fix the network quality issues	5	4	3	2	1
SC20	Keep existing subscribers on the network	5	4	3	2	1
SC21	Get customers to increase their spend on the network	5	4	3	2	1
SC22	Increase internet speed	5	4	3	2	1
SC23	Availability of network	5	4	3	2	1
SC24	Provide coverage	5	4	3	2	1
SC25	Complete tower build to a deployment of the full Sites	5	4	3	2	1
SC26	Deliver best in class services	5	4	3	2	1

B2: MEASURING OF CELL SITES PROJECT PERFORMANCE

#	Performance Measuring Criteria DURING cell site deployment	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
MC01	The deployment must be on Time (Schedule)	5	4	3	2	1
MC02	The deployment must be within Cost (budget)	5	4	3	2	1
MC03	The deployment must meet Quality metrics (such as availability; data speed; voice quality, clarity etc.)	5	4	3	2	1
MC04	The deployment must be within Scope (meeting requirement or speciation)	5	4	3	2	1
MC05	Project Team must be satisfied during deployment	5	4	3	2	1
MC06	Earned value analysis **(EVA)** is a technique you use to measure site rollout performance	5	4	3	2	1

SECTION C: VALUE LEAKS IN CELL SITES DEPLOYMENT

This section seeks to identify the measures that propel an occurrence of value leaks during cell site deployment. Please **mark** (**X**) on the number that best reflects your agreement with the following statements based on the given scales.

C1: VALUE LEAK MEASURES DURING CELL SITE DEPLOYMENT

#	Value Leaks Measures DURING cell site deployment	Strongly Agree	Agree	Neutral	Disagre	Strongly Disagre
VL01	Value leaks when deployment is not delivered on time	5	4	3	2	1
VL02	Value leaks when deployment is not delivered within cost	5	4	3	2	1
VL03	Value leaks when deployment is not delivered within quality metrics	5	4	3	2	1
VL04	Value leaks when deployment is not delivered within scope	5	4	3	2	1
VL05	Value leaks when project team is dissatisfied during deployment	5	4	3	2	1

C2a: VALUE LEAK FREQUENCY OF OCCURRENCE IN CELL SITE DEPLOYMENT

#	Frequency of value leaks occurrence	Always	Very Often	Sometimes	Rarely	Never
FVL01	How often does site rollout not delivered on time?	5	4	3	2	1
FVL02	How often does site rollout not delivered within cost?	5	4	3	2	1
FVL03	How often does site rollout not delivered within quality metrics (call drops etc.)?	5	4	3	2	1
FVL04	How often does site rollout not delivered within scope?	5	4	3	2	1
FVL05	How often does project team become dissatisfied during deployment?	5	4	3	2	1

C2b: APPROXIMATELY HOW LONG DOES SITE ROLLOUT DELAY?

Less than 2 months	2 to 4 months	5 to 7 months	8 to 12 months	above 1year
1	2	3	4	5

C2c: APPROXIMATELY HOW MUCH OF VALUE LEAKS DURING SITE ROLLOUT?

Less than $50K	$50K - $100K	$101K - $150K	$151K - $200K	above $200K
1	2	3	4	5

C3: IMPACT OF VALUE LEAKS ON CELL SITE DEPLOYMENT

Please **mark** (**X**) on the number that best reflects your agreement with each of these causal factors provided. Rate as follows: **1**= Strongly disagree, **2** = Disagree, **3** = Neutral, **4** = Agree, and **5** = Strongly agree

#	Impacts of Value Leaks on cell site deployment	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
IVL01	Value leak leads to risk of telco swapping the contracting vendor	5	4	3	2	1
IVL02	Value leak affects product launch or go-live date	5	4	3	2	1
IVL03	Value leak leads to revenue loss	5	4	3	2	1
IVL04	Value leak leads to customer dissatisfaction	5	4	3	2	1
IVL05	Value leak extends the payback period	5	4	3	2	1
IVL06	Value leak erodes brand image	5	4	3	2	1
IVL07	Value leak brings about Regulator fines	5	4	3	2	1
IVL08	Value leak delays customer acquisition	5	4	3	2	1
IVL09	Value leak impacts the project objective of expanding network coverage and improving customer experience; i.e. congestions, data speed etc.	5	4	3	2	1
IVL10	Value leak affects telecom CAPEX budget for the year	5	4	3	2	1
IVL11	Value leak impacts the schedule of the project	5	4	3	2	1
IVL12	Value leak affects the realisation of the business case	5	4	3	2	1
IVL13	Value leak impacts the quality of the projects	5	4	3	2	1
IVL14	Value leak impacts profit rate of the supplier	5	4	3	2	1
IVL15	Value leak impacts projections in the business case	5	4	3	2	1
IVL16	Value leak impacts to the return of investment	5	4	3	2	1
IVL17	Vale leak has financial impact on the company	5	4	3	2	1
IVL18	Value leak can derail the plan	5	4	3	2	1
IVL19	Value leak increases the cost of the project	5	4	3	2	1
IVL20	Value leak brings about rework impacting delivery timeliness	5	4	3	2	1
IVL21	Value leak brings about poor quality	5	4	3	2	1

SECTION D: FACTORS THAT CAUSE VALUE LEAKS IN THE CELL SITE PROJECTS

The objective of this section is to determine the factors that cause cell site deployment: (D1) **delay,** (D2) **go over budget,** (D3) **poor quality**, (D4) **out of scope**, and (D5) **team dissatisfaction.**

Please **mark** (**X**) on the number that best reflects your agreement with each of these causal factors provided. Rate as follows: **1**= Strongly disagree, **2** = Disagree, **3** = Neutral, **4** = Agree, and **5** = Strongly agree

D1: DELAYS (TIME OVERRUN)

#	Factors that cause delays (Time Overrun) in the cell site deployment	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
TO01	Issues with top management support	5	4	3	2	1
TO02	Poor monitoring and control	5	4	3	2	1
TO03	Poor scoping	5	4	3	2	1
TO04	Delay in seeking budget approval	5	4	3	2	1
TO05	Delay in clearing the hardware from the port	5	4	3	2	1
TO06	Delays in preparing the sites by the tower companies	5	4	3	2	1
TO07	Late issuing of Purchase Orders (Pos)	5	4	3	2	1
TO08	Too many parties involved in the project	5	4	3	2	1
TO09	Inaccurate time and cost estimate	5	4	3	2	1
TO10	Inadequate project resources	5	4	3	2	1
TO11	Lack of experienced contractors	5	4	3	2	1
TO12	Issues with project funding	5	4	3	2	1
TO13	Internal organisational processes	5	4	3	2	1
TO14	Poor/Lack of communication skills	5	4	3	2	1
TO15	Organisational cultures	5	4	3	2	1
TO16	Poor planning	5	4	3	2	1
TO17	Too many quality shortfalls that you have to do rework	5	4	3	2	1
TO18	Labour dispute (within the project team and the community)	5	4	3	2	1
TO19	Project manager's competency	5	4	3	2	1
TO20	Over-specification	5	4	3	2	1
TO21	Poor site management and supervision	5	4	3	2	1

TO22	Land dispute	5	4	3	2	1
TO23	Delay in material delivery since telecom equipment are not manufactured in-country but are imported	5	4	3	2	1
TO24	Landlords refusal to sign a contract for leasing of the land	5	4	3	2	1
TO25	Transmission and radio frequency plan readiness	5	4	3	2	1
TO26	Site permit acquisition from the regulatory, and district assemblies	5	4	3	2	1
TO27	Poor contract management	5	4	3	2	1
TO28	Any form of labour disputes	5	4	3	2	1

Please **mark** (**X**) on the number that best reflects your agreement with each of these causal factors provided. Rate as follows: **1**= Strongly disagree, **2** = Disagree, **3** = Neutral, **4** = Agree, and **5** = Strongly agree

D2: OVER BUDGET (COST OVERRUN)

#	Factors that cause over budget (Cost Overrun) in the cell site deployment	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
CO01	Inexperienced contractors	5	4	3	2	1
CO02	Schedule delays	5	4	3	2	1
CO03	Mistakes and errors in design	5	4	3	2	1
CO04	Limited engagement from project stakeholders	5	4	3	2	1
CO05	Supplier is unable to commit adequate qualified resources to the project to control the impact on financial performance	5	4	3	2	1
CO06	Issue with top management support	5	4	3	2	1
CO07	Forex exchange or exchange rate	5	4	3	2	1
CO08	Lack/Poor of communication skills	5	4	3	2	1
CO09	Inadequate planning and scheduling	5	4	3	2	1
CO10	Inaccurate time and cost estimate	5	4	3	2	1
CO11	Poor stakeholder management	5	4	3	2	1
CO12	Changes in materials cost (Inflation)	5	4	3	2	1
CO13	Scope changes or changes in requirements	5	4	3	2	1

CO14	Competencies of project resources (resources ability to estimate)	5	4	3	2	1
CO15	Gold plating or over-specification	5	4	3	2	1
CO16	Labour disputes/work stoppage	5	4	3	2	1
CO17	Taken insufficient information from end-users (requirement gathering)	5	4	3	2	1
CO18	Unstable organisational environment	5	4	3	2	1
CO19	Poor supervision and inspections	5	4	3	2	1
CO20	Poor contract management	5	4	3	2	1
CO21	Project manager's competency	5	4	3	2	1

Please **mark** (**X**) on the number that best reflects your agreement with each of these causal factors provided. Rate as follows: **1**= Strongly disagree, **2** = Disagree, **3** = Neutral, **4** = Agree, and **5** = Strongly agree

D3: POOR QUALITY

#	Factors that cause Poor Quality in the cell site deployment	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
PQ01	Poor supervision and site management	5	4	3	2	1
PQ02	Inexperienced project team and engineers	5	4	3	2	1
PQ03	Lack of quality assurance and control	5	4	3	2	1
PQ04	Lack or Poor communication skills	5	4	3	2	1
PQ05	Unclear KPIs	5	4	3	2	1
PQ06	Pressure to deliver the project	5	4	3	2	1
PQ07	Climate condition at the site	5	4	3	2	1
PQ08	Incompetence subcontractor or contractors	5	4	3	2	1
PQ09	Hostile socio-economic environment	5	4	3	2	1
PQ10	Conflict among project team	5	4	3	2	1
PQ11	Poor working relationship among team members	5	4	3	2	1
PQ12	Lack of Project Manager knowledge	5	4	3	2	1
PQ13	Lack of quality focus	5	4	3	2	1

PQ14	Limited project information	5	4	3	2	1
PQ15	Gold plating	5	4	3	2	1
PQ16	Changing quality needs during project implementation	5	4	3	2	1
PQ17	Poor scope alignment	5	4	3	2	1
PQ18	Lack of understanding of end-user requirement	5	4	3	2	1
PQ19	Poor monitoring and control	5	4	3	2	1
PQ20	Unsupportive organisational culture	5	4	3	2	1
PQ21	Poor deliverable quality	5	4	3	2	1
PQ22	Conflicting requirement	5	4	3	2	1
PQ23	Poor client-vendor relationship	5	4	3	2	1
PQ24	Scope creeping	5	4	3	2	1
PQ25	Poor project conceptualisation	5	4	3	2	1

Please **mark** (**X**) on the number that best reflects your agreement with each of these causal factors provided. Rate as follows: **1**= Strongly disagree, **2** = Disagree, **3** = Neutral, **4** = Agree, and **5** = Strongly agree

D4: OUT OF SCOPE

#	Factors that cause cell site deployment not meeting requirement (Out of Scope)	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
UP01	Lack of detailed scope	5	4	3	2	1
UP02	Scope creep	5	4	3	2	1
UP03	Lack of stakeholder involvement	5	4	3	2	1
UP04	Poor communication skills	5	4	3	2	1
UP05	Conflicting requirement	5	4	3	2	1
UP06	Over-specification	5	4	3	2	1
UP07	Unclear scope requirements	5	4	3	2	1
UP08	Inconsistent process for collecting product requirements in relation to the industry standards	5	4	3	2	1
UP09	Poor scope management	5	4	3	2	1

UP10	Excessive restriction of project budget	5	4	3	2	1
UP11	Lack of top management support	5	4	3	2	1
UP12	Inaccurate time and cost estimates	5	4	3	2	1
UP13	Terrain (project environment)	5	4	3	2	1
UP14	Non-availability of experienced contractor	5	4	3	2	1
UP15	Different geographical locations	5	4	3	2	1
UP16	Poor standard of workmanship	5	4	3	2	1

D5: TEAM DISSATISFACTION

#	Factors that cause team dissatisfaction during cell site deployment	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
TD01	Politics within the organisation and its negative effect	5	4	3	2	1
TD02	Different geographical location	5	4	3	2	1
TD03	Poor client and vendor relationships	5	4	3	2	1
TD04	Lack of earlier team members engagement	5	4	3	2	1
TD05	Pressure from Project Manager	5	4	3	2	1
TD06	Extra working hours	5	4	3	2	1
TD07	Conflicts among project stakeholders	5	4	3	2	1
TD08	Delay in payment to vendors/supplier/subcontractor	5	4	3	2	1
TD09	Excessive changes to project scope	5	4	3	2	1
TD10	Politicking among team members	5	4	3	2	1
TD11	Lack of clear scope	5	4	3	2	1
TD12	Scope creep	5	4	3	2	1
TD13	Project Manager's incompetence	5	4	3	2	1
TD14	Commitment among project participants	5	4	3	2	1
TD15	Different geographical locations (working in different time zones)	5	4	3	2	1
TD16	Changes in organisational management and leadership	5	4	3	2	1
TD17	Unsupportive organisational culture	5	4	3	2	1

TD18	Lack of top management support	5	4	3	2	1
TD19	Cumbersome organisational processes	5	4	3	2	1
TD20	Poor or Lack of communication skills	5	4	3	2	1
TD21	Poor or Lack of motivation and monetary rewards	5	4	3	2	1
TD22	Too many reworks due to poor quality	5	4	3	2	1

SECTION E: SOURCES OF THE CAUSAL FACTORS (VALUE LEAKS) IN THE CELL SITE PROJECTS

The intent of this section is to find out whether the causal factors originate or come from: (E1) **project stakeholders,** (E2) **project environment**, and (E3) **project life cycle.**

Please **mark** (**X**) on the number that best reflects your agreement with each of these causal factors provided. Rate as follows: **1**= Strongly disagree, **2** = Disagree, **3** = Neutral, **4** = Agree, and **5** = Strongly agree

E1. PROJECT STAKEHOLDERS

#	Factors that come from project stakeholders during cell site deployment	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
PS01	Poor client and vendor relationships	5	4	3	2	1
PS02	Lack of earlier team members engagement	5	4	3	2	1
PS03	Excessive pressure from project manager	5	4	3	2	1
PS04	Conflicts among project stakeholders	5	4	3	2	1
PS05	Lack or Poor communication skills	5	4	3	2	1
PS06	Lack of motivation and monetary rewards	5	4	3	2	1
PS07	Lack of clear scope and scope creep	5	4	3	2	1
PS08	Payment of remunerations (salaries)	5	4	3	2	1
PS09	Changes in organisational management and leadership	5	4	3	2	1
PS10	Inaccurate time and cost estimate	5	4	3	2	1
PS11	Delay in seeking budget approval	5	4	3	2	1
PS12	Late delivery of materials	5	4	3	2	1
PS13	Lack of experienced contractors	5	4	3	2	1

PS14	Lack of Project manager's competency	5	4	3	2	1
PS15	Land dispute	5	4	3	2	1
PS16	Too many reworks due to poor quality	5	4	3	2	1
PS17	Issues of project funding	5	4	3	2	1
PS18	Poor contract management	5	4	3	2	1
PS19	Changes in requirements changes	5	4	3	2	1
PS20	Inexperienced project team and engineers	5	4	3	2	1
PS21	Lack of stakeholder involvement	5	4	3	2	1
PS22	Excessive restriction of project budget	5	4	3	2	1
PS23	Poor site management and supervision	5	4	3	2	1
PS24	Over-specification	5	4	3	2	1
PS25	Site permit acquisition	5	4	3	2	1
PS26	Issues with top management support	5	4	3	2	1
PS27	Inadequate planning and scheduling	5	4	3	2	1
PS28	Poor stakeholder management	5	4	3	2	1

Please **mark** (**X**) on the number that best reflects your agreement with each of these causal factors provided. Rate as follows: **1**= Strongly disagree, **2** = Disagree, **3** = Neutral, **4** = Agree, and **5** = Strongly agree

E2. PROJECT ENVIRONMENT

#	Factors that come from project environment during cell site deployment	Strongly Agree	Agree	Neutral	Disagre	Strongly Disagre
PE01	Politics within the organisation and its negative effect	5	4	3	2	1
PE02	Different geographical location	5	4	3	2	1
PE03	Delay in payment to vendors/supplier/subcontractor	5	4	3	2	1
PE04	Lack of motivation and monetary rewards	5	4	3	2	1
PE05	Cumbersome organisational processes	5	4	3	2	1
PE06	Poor or lack of Communication skills	5	4	3	2	1
PE07	Internal approval processes	5	4	3	2	1
PE08	Poor client-vendor relationship	5	4	3	2	1
PE09	Any form of labour disputes	5	4	3	2	1
PE10	Inexperienced contractors	5	4	3	2	1
PE11	Changes in organisational management and leadership	5	4	3	2	1
PE12	Forex exchange or exchange rate	5	4	3	2	1
PE13	Inconsistent process for collecting product requirements in relation to the industry standards	5	4	3	2	1
PE14	Non-availability of project contractors	5	4	3	2	1
PE15	Delays in preparing the sites by the tower companies	5	4	3	2	1
PE16	Delay from the vendor side in importing the hardware into the country	5	4	3	2	1
PE17	Delay in clearing the hardware from the port	5	4	3	2	1
PE18	Site permits by the communities	5	4	3	2	1
PE19	Organisational culture	5	4	3	2	1
PE20	Land dispute	5	4	3	2	1
PE21	Delay in material delivery	5	4	3	2	1
PE22	Transmission and radio frequency plan readiness	5	4	3	2	1
PE23	Lack of experience of contractors	5	4	3	2	1

PE24	Changes in materials cost (Inflation)	5	4	3	2	1
PE25	Unstable organisational environment	5	4	3	2	1

Please **mark** (**X**) on the number that best reflects your agreement with each of these causal factors provided. Rate as follows: **1**= Strongly disagree, **2** = Disagree, **3** = Neutral, **4** = Agree, and **5** = Strongly agree

E3. PROJECT LIFE CYCLE

#	Factors that come from project life cycle during cell site deployment	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
PL01	Poor contract management	5	4	3	2	1
PL02	Poor scoping	5	4	3	2	1
PL03	Poor monitoring and control	5	4	3	2	1
PL04	Lack of top management support	5	4	3	2	1
PL05	Mistake and errors in design	5	4	3	2	1
PL06	Delay in seeking budget approval	5	4	3	2	1
PL07	Delays in preparing the sites by the tower companies	5	4	3	2	1
PL08	Delay from the vendor side in importing the hardware into the country	5	4	3	2	1
PL09	Delay in clearing the hardware from the port	5	4	3	2	1
PL10	Inadequate resources	5	4	3	2	1
PL11	Inaccurate time and cost estimate	5	4	3	2	1
PL12	Issues of project funding	5	4	3	2	1
PL13	Transmission and radio frequency plan readiness	5	4	3	2	1
PL14	Lack of earlier team members engagement	5	4	3	2	1
PL15	Pressure from project manager	5	4	3	2	1
PL16	Extra working hours	5	4	3	2	1
PL17	Delay in payment to vendors/supplier/subcontractor	5	4	3	2	1
PL18	Too many reworks due to poor quality	5	4	3	2	1
PL19	Poor management of team motivation and motivational drivers	5	4	3	2	1

PL20	Excessive changes to project scope	5	4	3	2	1
PL21	Poor or lack of communication skills among project stakeholders	5	4	3	2	1
PL22	Lack of clear scope and scope creep	5	4	3	2	1
PL23	Payment of remunerations (salaries)	5	4	3	2	1
PL24	Poor client-vendor relationship	5	4	3	2	1
PL25	Over-specification	5	4	3	2	1
PL26	Site permit acquisition	5	4	3	2	1
PL27	Limited engagement from project stakeholders	5	4	3	2	1
PL28	Schedule delays	5	4	3	2	1
PL29	Changes in requirements	5	4	3	2	1
PL30	Inadequate planning and scheduling	5	4	3	2	1
PL31	Fluctuation of prices of material	5	4	3	2	1
PL32	Incompetent subcontractors	5	4	3	2	1
PL33	Poor stakeholder coordination	5	4	3	2	1
PL34	Lack of scope management	5	4	3	2	1
PL35	Conflicting requirement	5	4	3	2	1
PL36	Excessive restriction of project budget	5	4	3	2	1
PL37	Inconsistent process for collecting product requirements in relation to the industry standards	5	4	3	2	1

Thank you for the participation

APPENDIX 4:

COMPREHENSIVE FINDINGS WITH RESPECT TO THE MAIN THEMES, KEY QUOTES, AND KEY WORDS FROM THE PARTICIPANTS

APPENDIX 4.1: VALUE LEAKS IN SITE PROJECT

OBJECTIVE 1: CRITICAL ANALYSIS OF VALUE LEAKS' CAUSAL FACTORS DURING PROJECT DEPLOYMENT							
INTERVIEW GUIDE QUESTIONS	**KEY QUOTES**	**COMPANY "A" KEY WORDS FROM NARRATIVE**	**COMPANY "B" KEY WORDS FROM NARRATIVE**	**COMPANY "C" KEY WORDS FROM NARRATIVE**	**COMPANY "D" KEY WORDS FROM NARRATIVE**	**ELEMENTS DERIVED FROM NARRATIVES**	**TRANSCRIPT REFERENCES**
Value in delivering Site project	**#D1**. Cell site rollout project provides better network access and increase speed **#D2**. The value of delivering cell sites is ability to achieve the network KPIs stated in the business case. The outcome of delivering value through cell sites projects are to drive revenue, increase our mobile penetration, keep existing customers and get them to increase their spend on the network. Also, building more sites is a function of addressing quality issues, there could be a capacity concerns on the network where additional sites would fix the quality issues so enhancing user experience. **#D3**. Cell sites are what give coverage for telecommunication services. It aims at increasing coverage capacity and in some cases, meet regulatory requirements to avoid any kind of penalties or fines. Capacity is meant to enhance customer experience. We undertake cell sites project to introduce new technologies such as in the 4G LTE in recent. **#D4**. Cell site rollout is deployment of a telecom infrastructure in green field which aims at achieving better network capacity, extended coverage, speech quality and data access improvements or to resolve network congestions	#D3. Increase coverage; enhance customer experience; meet regulatory requirements ; avoid regulatory fines; introduce new technologies (Transcript 1,3:7-8, 52)	#D4. better network capacity; extended coverage; resolve network congestions etc. (Transcript 3, 4:7-8, 54) #D5. introduce mobile coverage to green field; reduce congestion; capacity expansions; (Transcript 2,5:7-10, 62)	#D1. provide better network access; increase internet speed; availability of network; expand and enhance organisational network system (Transcript 4, 1:7, 53)	#D6. provide coverage; upgrade of a particular site; complete tower builds to a deployment of the full sites (Transcript 5, 6:7,44) #D2. deploying radio access network; etc.(Transcript 6, 2:7, 42)	The value of delivery site project is mainly to provide access to telecom services.	Transcript 1,3:7-8, 52 Transcript 2,5:7-10, 62 Transcript 3, 4:7-8, 54 Transcript 4, 1:7, 53 Transcript 5, 6:7,44 Transcript 6, 2:7, 42

	#D5. Cell site projects are embarked on to introduce mobile coverage to green field. Also, embarked on to reduce congestion being experienced on some cell site due to traffic growth. i.e. Capacity expansions **#D6**. Cell Sites rollout project is deployment of telephone sites at a location to provide coverage						
Criteria to measure the value of delivery site projects	**#D1**. The delivering of site project value must be within budget, meet the go-live date, meet the quality metrics such as availability, data speed, coverage and voice clarity etc. Also, ability to achieve the network KPIs stated in the business case. **#D2.** Delivering the service that the customers aspire, most importantly whether we are creating shareholder value as a result of delivering the sites. Is the site delivering on the promised revenues? So, if the site delivers the right customers experience, it would definitely meet the projected revenue we set out. **#D3.** First is the time (schedule), time is important because there has to be return on an investment. and meeting your schedule means that you can stay within your budget. Second, we look at cost, third, we look at scope or the specification and lastly, we look at quality of the implementation. The network KPIs are the measure of the experience of subscribers. This may be measured by telco themselves or use a third-party benchmark company. Ultimately revenue growth or generation from these sites are also a measure of the value of the cell site. For suppliers, value is measured via the project P & L and also through customer satisfaction which we do through periodic surveys; for suppliers some site rollout projects serve as strategic projects which can help to increase market share or capture high value areas. **#D4.** Largely, because you break your delivery work into work packages; each work package, you would have assigned some value in terms of what is costing you, how much time you are using on that, what that time translate into in terms of man-hours or workdays. So, all these ends up giving you an understanding of your earned value. So, the cost you have ascribed to a particular work package at the end of delivering that work.	#D3. time (schedule), network KPIs, increase market share or capture high value areas, etc. (Transcript 1,3:53)	#D4. Work packages, what is costing you, how much time you are using on that (Transcript 3, 4:55) #D5. Within budget, schedule, quality metrics. (Transcript 2,5:63)	#D1. Budget, go-live date, meet the quality metrics such as availability etc. (Transcript 4, 1:54)	#D6. Scope, time and budget or cost (Transcript 5, 6:45) #D2. on time, within budget, and within scope and all the quality metrics (Transcript 6, 2:43)	The criteria to measure sites projects during deployment are schedule (Go live date), budget, quality metrics such as availability; data speed; voice quality and clarity, scope and team satisfaction The criteria to measure post implementation of cell sites projects are network KPIs, customer satisfaction, revenue growth, project P & L, strategic projects, increase market share, capture high areas.	Transcript 1,3:53 Transcript 2,5:63 Transcript 3, 4:55 Transcript 4, 1:54 Transcript 5, 6:45 Transcript 6, 2:43

	#D5. The project is delivered within budget, the schedule is met as when I mean the schedule is the go-live date of getting that site on air is met, the quality metrics such as availability, data speed, and voice quality and clarity. Also, ability to achieve Sites rollout KPIs stated in the business case and time to market so revenues are realised per schedule. **#D6**. Usually beginning of the project, from the budgetary point of view there is a cost estimates, the agreed go-live timeliness and also there is certain KPI thresholds that are for structural integrity for equipment installations and then also for service delivery as well. All these metrics need to be met to be able to say that you have provided value for delivering the project						
Duration of Site project	**#D1.** The number of sites and activities involved determine the duration. We have the minimum, which is 3 months, 6 months, 1 year and the maximum is 2 years **#D2**. It depends on the site count and objectives of the project. If rollout 200 sites in a month would meet the Telco's revenue target, every measure would be put in place to achieve that **#D3**. It depends on the scope, ..time it takes to manufacture the equipment and ship ...colocation or greenfield. In Ghana over the years now, I would say that a typical duration for cell site rollout is around 4 to 6 months. Most operators, they are doing around 250-300 sites in terms of a rollout **#D4**. Greenfield rollout, largely it ranges between 6 to 12 weeks which involves importation of hardware. Green fields generally, we talk about places that are not already served by the telecom service **#D5**. A typical cell site can take 4 to 6 weeks and depends on quite a number of factors...to get regulatory approval, ...get equipment from the vendor, if you want to include all of these it would take 4 to 6 weeks to 3 months. When all regulatory approvals are given, deployment takes 2 weeks which includes post testing and acceptance of the sites. The project in totality from initiation through to closure, it can take up to 3 months but just implementation or deployment can take 2 weeks. A greenfield is areas where there is no coverage.	#D3. Scope; Colocation; Greenfield; Equipment manufacturing and shipment; 4 to 6 months (Transcript 1,3:15-16)	#D4. Greenfield; Importation of hardware; 6 to 12 weeks (Transcript 3, 4: 8, 13) #D5. Depends on number of factors; Regulatory approval, deployment 2 weeks; equipment from vendor, 4 to 6 weeks etc. (Transcript 2,5: 12, 16-18)	#D1. Depends on number of sites and activities; Minimum 3months to 1 year and Maximum 2 years (Transcript 4, 1:10-11)	#D6. Number of sites involved; Greenfield; Brownfields; 6months to 2 years for both (Transcript 5, 6: 8-9, 12) #D2. Sites count and objectives Transcript 6, 2:10-11)	*Duration depends on project objectives; Number sites involved; Colocation; Greenfield; Brownfield; Equipment manufacturing; Hardware shipment; Regulatory approval; Scope. *Greenfield takes 6month to 2 years. Greenfields is a completely new location deploying the tower and then deploying the site equipment on it *Brownfield is an upgrade on	Transcript 1,3:15-16 Transcript 2,5:16-18 Transcript 3, 4:13 Transcript 4, 1:10-11 Transcript 5, 6:12 Transcript 6, 2:10-11

	#D6. Duration is determined by the number of sites involved. From practical experience, it ranges from 6 months to 2 years based on the number of greenfield and brownfields are involved. A green field is basically a completely new location deploying the tower and then deploying the site equipment on it. A brown field is an upgrade on an existing site, or an additional technology introduce to an existing site					a existing sites or additional technology will be added on itV	
Costs involved to rollout a site project	**#D1**. It is capital intensive which ranges from $100K and it depends on the magnitude of the project. You cannot classify a single cell site as a project. For site rollout, we can have a minimum of 30 sites and these 30 sites ranges from $100K to $250K. **#D2**. One of the major cost components in site rollout is the cost of equipment. …the equipment is imported, which means there is a lot of reliance on foreign currency to import it. …eexternal factor as the forex exchange also plays a huge impact on the cost of the project. …the external factors contribute to cost inflation of the rollout. **#D3**. Telecommunication is not cheap; it is capital intensive and very expensive. For a single technology greenfield site, we are looking at around $80K and for colocation we are looking at around $40K **#D4.** Cost is usually enormous, and it is not fixed to box because it depends on nature of the field you are going to work in and the constraints you have to outrun. From my experience, a site could range between $10K to $20K **#D5.** The cost is capital intensive as services alone is in excess of USD 7.5K for Radio access, Network and transmission installation and equipment supply in the region of USD 10K per cell site. In the region of USD 25K for active components. *base transceiver station, the antennas* and a passive component where based on the structure, cell sites carriers do not own the physical infrastructure like the LAN, towers, generators, those are termed as the passive elements. **#D6**. Site deployments are very capital intensive and the costs are quite high	#D3. Telecommunication is not cheap, capital intensive, very expensive, technology greenfield site, $80K, colocation, $40K (Transcript 1,3:29)	#D4. Enormous cost, nature of the field, $1000 to $20,000 USD 10K per cell site, (Transcript 3, 4:23-24) #D5. Capital intensive, USD 7.5K, USD 10K per cell site, GHs 13K to 14K to every towercos (Transcript 2,5:28-31)	#D1. Depends on number of sites and activities; Minimum 3months to 1 year and Maximum 2 years (Transcript 4, 1:23)	#D6. capital intensive (Transcript 5, 6:21) #D2. cost of equipment, reliance on foreign currency, inflation, forex exchange Transcript 6, 2:21)	Sit projects are capital intensive, a minimum of 30 sites could cost about $100K to $250K. This comes with a monthly rent fee of about GHs 13K to 14K to the Towercos.	Transcript 1,3:29 Transcript 2,5:28-31 Transcript 3, 4:23-24 Transcript 4, 1:23 Transcript 5, 6:21 Transcript 6, 2:21
	#D2. The value leak is the opportunity cost of not finish on time. We need the site on the particular date to deliver a	#D3 only continue to	#D4. value that is lost if		#D6. the money finishes	Value leaks can be	Transcript 1,3:54

Extent to consider value leaks during site project deployment	special event which is supposed to bring in customers on a particular site and we failed to turn on the site on that particular date, obviously then the value is lost. **#D3**. I can give an example of a competitor's case working in one of the telcos, who accepted to do one of the projects and this project actually run into a lot of cost overruns and the initial projections were not met. So subsequently, the inability to deliver according to the customers' expectations left to several years of dissatisfaction by the telco. Eventually, that supplier was replaced. For suppliers this kind of loss of value is very important to us because the operator will only continue to invest if the value of the project is realised if there is no value then future business will definitely be at risk. **#D4**. Value comes in multiple forms and falls in all the constraints the project sits in. There is value that is lost if cost is impacted, there is value lost when your schedule extends, there is value lost when you deliver low quality or your quality metrics are impacted and you have to do rework, there is value lost when your stakeholders are dissatisfied, and you have to make extra investment of time, cost or additional skills or expertise to manage their interest and get them to faith in the business you are out to do **#D5**. The occurrence of over budget, schedule delay, rework due to poor quality can prolong the go live date resulting in delays in revenue realisation and delays in customer acquisition which means value may be considered lost. **#D6**. The value would definitely be missed if the cost budgeted; the money finishes before the project is delivered, if the time is exceeded, if an installation is done wrongly, all these would reduce the value of the project	invest if the value of the project is realised if there is no value then future business will definitely be at risk (Transcript 1,3:54)	cost is impacted, schedule extends, deliver low quality etc. (Transcript 3, 4:56) #D5. delays in revenue realisation, delays in customer acquisition, etc. (Transcript 2,5:64)		before the project is delivered (Transcript 5, 6:64) #D2. opportunity cost of not finish on time (Transcript 6, 2:45)	considered when budget goes over (cost overrun), schedule extends (time overrun), scope creep (out of scope), stakeholders are dissatisfied, and quality metrics are impacted (rework).	Transcript 3, 4:56 Transcript 4, 1:55 Transcript 5, 6:64 Transcript 6, 2:45

Estimate the amount of value that leaks during site project	**D1**. You can have 1 to 2 weeks delays which is adjustable but when a delay comes for 1 month or more, then it becomes a big issue. Because, when it is 1 or 2 weeks, you can mitigate it by putting much effort to overcome that delays. But when it goes beyond a month, then it turns red which is no go area. Because going a month means, you are going to increase your cost and resources **#D2**. Because of the experience we have built over the years and the fact that we try to mitigate these as much as possible, for every 10 sites, there could be just one or two, which can go up to 3 to 4 weeks' time overrun if the right permitting gets delayed. **#D3**. We can have 1 to 2 months delays and this varies from an operator to operator. Different operators have different internal processes and different organisational cultures which affect the time overrun. Value may be impacted but where the additional cost is borne by the telco or the supplier it may not be considered as lost. The potential return on investment may be impacted. **#D4.** Value leaks on general front happens sometimes. If you look at it on the whole, i.e. in terms of cost, quality, schedule, 3 to 5 weeks' time overrun can happen. There was one project that delayed for about 3 weeks. You can also exceed your budget between $100K and sometimes up to $120K **#D5**. We can have time overrun of 3 weeks and poor quality resulting in rework which increases the project cost.	#D3. 1 to 2 months delays (Transcript 1,3:31)	#D4. 3 to 5 weeks' time overrun; exceed your budget between $100K and sometimes up to $120K (Transcript 3, 4:40) #D5. time overrun of 3 weeks and poor quality resulting in rework (Transcript 2,5:33)	#D1. 1 to 2 weeks delays which is adjustable (Transcript 4, 1:27)	#D2. 3 to 4 weeks' time overrun (Transcript 6, 2:25)	Site projects go over budget as high as $120K resulting from delays, reworks. Also, Site projects experience 1 to 2 months delays which varies from one operator to the other	Transcript 1,3:31 Transcript 2,5:33 Transcript 3, 4:30 Transcript 4, 1:27 Transcript 5, 6:23

Extent to which value leaks become problematic in delivery site project ***(i) Frequency of value leaks occurrence in site project***	**#D1.** Value leaks affects the project budget, resulting from cost overrun and rework due to poor quality. It can also affect the product launch date for example if we are rolling out 4G into the market to gain competitive advantage, value leaks can cause the launch date to delay. **#D2**. The overall effect is the fact that you lose out on the opportunity of the revenues that come on the site. If the daily revenue of a site is Ghs10K, it is Ghs10K loss for each day. **#D3**. You may face a risk of a swap, where the telco might replace you with your competitor. From the operators' perspective, the business case from the whole project will be questionable when there are delays because the projections are not met. And from the Vendors' perspective, delays will increase in cost because of their daily rate for some of the resources that are engaged to do the work. I would say sometimes. **#D4.** There could be fines from the Regulator which erodes your image, your brand is impacted, customers are dissatisfied, so value in multiple forms are impacted. Value leaks on general front happens sometimes **#D5**. With cost overrun, the project value of expanding network coverage and improving customer experience, you would not able to meet it because you are not able to fund it. **#D6**. If there is any quality that is degraded in the delivery of the project, what it means is that the acceptance of the project would delay which extends the project timeliness and then you need to retain resources at extra cost to be able to fix whatever quality issues that come up. it happens rarely	#D3. You may face a risk of a swap, where the telco might replace you with your competitor. (Transcript 1,3:26-27)	#D4. fines from the Regulator which erodes your image (Transcript 3, 4:18) #D5. cost overrun, (Transcript 2,5:23-24)	#D1 It can also affect the product launch date (Transcript 4, 1:19-20)	#D6. the acceptance of the project would delay which extends the project timeliness (Transcript 5, 6:22) #D2. lose out on the opportunity of the revenues that come on the site Transcript 6, 2:21)	Whereas the vendors are more concerned about the risk of getting replaced by the mobile operators leading to loss of future business, the operators also care so much about the revenue loss, regulatory fines, customer dissatisfaction leading to bad brand image	Transcript 1,3:26-27, 65 Transcript 2,5:23-24 Transcript 3, 4:18, 57 Transcript 4, 1:19-20, 56 Transcript 5, 6:22, 47 Transcript 6, 2:21,46
How such value leaks occurrence s are rectified	**#D1** …bring in experienced people which would cost you extra budget to complete the work. If you do not do that and the customer lose hope in you, they may charge you for delaying the project. Also, you ensure constant monitoring and controlling of the KPIs in measuring the delivering of Cell Sites rollout project. **#D2**. This is the business of airtime so whatever you lose	#D3. routine checks and surveys are conducted with operators as gauge	#D4. Quality means you need to do extra performance monitoring. (Transcript 3, 4:7-8)	#D1 bring in experienced people which would cost you extra budget (Transcript 4, 1:7)	#D6 quality metrics are always checked at the right time (Transcript 5, 6:7)	Extra value is sacrificed to attain the planned value	Transcript 1,3:64 Transcript 2,5:75 Transcript 3, 4:67

	in a particular time is not recovered. Learn from it and make sure that in future occurrence you try to take the learns learnt and prevent reoccurrence of such loss. Also, we try as much as possible to fast-track and address the causal effect of the delays **#D3.** Once value leaks are identified, mitigation steps are out in place almost immediately. We have routine checks and surveys are conducted with operators as gauge or barometer to help us ensure the value of customer satisfaction is maintained. When it comes to value losses in terms of staying out of the budget, there is a system tool that provide control and monitors the project budget to ensure that these things do not happen. If they happen, they are mitigated through variations and going for further application for budget. Project delays we need to pump in more resources to catch up the time. For which case, the cost must be accepted by the company as a loss. **#D4.** Value leaks in multiple areas e.g. quality means you need to do extra performance monitoring. So, the earlier you are able to monitor the KPIs of your sites and identify the issues, the earlier you are able to rectify situation and prevent further degradations. In terms of stakeholders: the earlier you identify the sentiments and concerns and address it, the earlier you are able to prevent the cancer from spreading. **#D5**. We ensure monitoring and control tasks contained in the project management plan are executed to the letter and there is effective communication as well. Also, we applied crashing and fast tracking which all the time have cost implication and revenue realisation would not come in as per scheduled. **#D6.** Find other activity that you would be able to use to beat up the time. There are quick wins-activity that based on your project plan, you might have to either secure resources or get resources to work overtime to able to meet that timeliness. Benchmark your projected cost to what is realised which allows you to be able to get any red flags as soon as value leaks come so that you would use the contingency budget to manage it.	(Transcript 1,3:7-8)	#D5 Ensure monitoring and control tasks (Transcript 2,5:7-10)		#D2. fast-track and address the causal effect of the delays (Transcript 6, 2:7)		Transcript 4, 1:62 Transcript 5, 6:53 Transcript 6, 2:52

APPENDIX 4.2:

MEASURES AND THEIR CAUSES OF VALUE LEAKS

OBJECTIVE 1: CRITICAL ANALYSIS OF VALUE LEAKS' CAUSAL FACTORS DURING PROJECT MANAGEMENT								
CATEGORISED AREAS	**INTERVIEW GUIDE QUESTIONS**	**KEY QUOTES**	**COMPANY "A" KEY WORDS FROM NARRATIVE**	**COMPANY "B" KEY WORDS FROM NARRATIVE**	**COMPANY "C" KEY WORDS FROM NARRATIVE**	**COMPANY "D" KEY WORDS FROM NARRATIVE**	**ELEMENTS DERIVED FROM NARRATIVES**	**TRANSCRIPT REFERENCES**
TIME OVERRUN (TO)	*Definition of project time overrun*	**#D1**. When a project is scheduled to be done within 3 months and it actually takes 4 to 5 months to complete, that is time overrun. **#D2**. Every project has a set time that has to be completed. It has a start time and a finish time, once the finish time is missed then there is an occurrence of time overruns. **#D3.** Time overrun is the additional time spent to complete the project after the originally planned date could not be achieved. **#D4**. Time overrun is generally indicating your deviation or exceeding the time you have initially planned to execute your site rollout. **#D5**. It is essentially the additional time we have to spend to complete a project after the planned delivery date is not achieved	#D3. additional time spent to complete the project (Transcript 1,3:92)	#D4. exceeding the time (Transcript 3, 4:89) #D5. additional time spend to complete a project (Transcript 2,5:170)	#D1. …to be done within 3 months and it actually takes 4 to 5 months to complete t (Transcript 4, 1:79)	#D2. once the finish time is missed then there is an occurrence of time overruns (Transcript 6, 2:65)	Time overrun can be explained as the additional time used to complete the project activities after missing out the initial finish date	Transcript 1,3:92 Transcript 2,5:170 Transcript 3, 4:89 Transcript 4, 1:79 Transcript 6, 2:65
	Frequency and approximation of time overrun occurrence	**#D1**. Sometimes, …when it is 1 or 2 weeks, you can mitigate it by putting much effort to overcome that delays. But when it goes beyond a month, then it turns red which is no go area. Because going a month means, you are going to increase your cost and resources. **#D2** Sometimes, it can go up to 3 to 4 weeks if the right permitting gets delayed. **#D3.** 1 to 2 months delays and this varies from an operator to operator. Different operators have different internal processes and different organisational cultures which affect the time overrun. **#D4.** It happens often and approximately; 3 to 5 weeks	#D3. Sometimes, ...different internal processes and different organisational cultures (Transcript 1,3:25)	#D4. sometimes, 3 to 5 weeks overruns (Transcript 3, 4:16-17) #D5. Sometimes, overrun of 3 weeks (Transcript 2,5:21)	#D1. Sometimes, 1 to 2 weeks delays (Transcript 4, 1:17-18)	#D6. sometimes (Transcript 5, 6:16) #D2. Sometimes, 3 to 4 weeks if the right permitting gets delayed (Transcript 6, 2:16,18)	Time overruns occurs sometimes	Transcript 1,3:25 Transcript 2,5:21 Transcript 3, 4:16-17 Transcript 4, 1:17-18 Transcript 5, 6:16 Transcript 6, 2:16,18

		overruns can happen. There was one project that delayed for about 3 weeks **#D5**. Sometimes and approximately it can give you an overrun of 3 weeks. **#D6.** Sometimes						
	Description of project delay (time overrun) impact on delivery of site projects	**#D1.** Time overrun has a negative impact on a Cell Sites rollout project because time is one of the three triple constraints and any deviation from the schedule influences the cost and scope of the project to change. When a project delays like that all the other factors come in. Your cost will increase, for example, if you have to spend $20K for a project, delay for a month or 2 can increase your cost to $30K. So, in that, it makes you somehow inefficient in project delivery. **#D2.** You start deriving revenues from the site the moment the site goes on air. Let's say the site is supposed to give you a monthly revenue of Ghs10K so for every 4weeks delay, it is GHs10K lost. **#D3.** Time overrun obviously has negative impact on cell site rollout project and time is a constraint in any project delivery. This will impact the cost, and sometime the scope of the project will change. Time overrun really has huge impact on the cost and the suppliers as well. **#D4**. There are cases where this leads to team dissatisfaction, because you at times hold people to greenfield that are in very remote area. The team is on-site and very little things are delaying the work and they cannot get to their families **#D5.** So before one decides to deploy at a location, there would have been a business case to determine what sort of revenues you are going to get and based on that there is time plan on how to meet those targets. So, if I am not able to go live on a certain date, it means the expected revenues do not come and this is the effect of your schedule delay **#D6.** It means what you planned getting, within a period of time would not be realised which would have financial impact on the company	#D3. Time overrun has negative impact on cell site rollout project. Time is a constraint in any project delivery. (Transcript 1,3:26-27)	#D4**.** this leads to team dissatisfaction, because you at times hold people to greenfield that are in very remote area. (Transcript 3, 4:18) #D5. if I am not able to go live on a certain date, it means the expected revenues do not come in (Transcript 2,5:23-24)	#D1. …any deviation from the schedule influences the cost and scope of the project to change, (Transcript 4, 1:19-20)	#D2. you start deriving revenues from the site the moment the site goes on air. (Transcript 6, 2:19)	Time overrun has financial impact on both the operator (telco) and the vendor (contractor). As it can affects project go live date, increase project cost, lead to team dissatisfaction resulting and its overall effects is loss of revenue and value.	Transcript 1,3:26-27 Transcript 2,5:23-24 Transcript 3, 4:18 Transcript 4, 1:19-20 Transcript 6, 2:19
	Outline the project	**#D1**. It depends on the RFI (i.e. Ready for integration or Ready for implementation) of the site, in terms of customer making the things needed to rollout the site	#D3. internal organisatio	#D4. too many quality	#D1. internal approval	#D6. Any form of labour	Lack/issue with Top Management Support; Poor	Transcript 1,3:184 Transcript

	delay causal factors	and there is delay from that side, it will cause delay in rollout as well. Ready for integration: this is when all installations have been done, and we need to integrate or commission the site. So, we can easily take the equipment and install on the tower. Ready for installation/implementation: civil works and other physical things like building the tower, providing power and generator are done. Again, lack of top management support, poor contract management, poor monitoring and control, poor scoping, internal approval processes. **#D2.** There are different things that cause delays, it could be delay in seeking budget approval to even start the project, it could be delay from the vendor side in importing the hardware into the country, it could delay in clearing the hardware from the port, it could be delays in preparing the sites itself for the rollout. So, the tower companies must prepare the sites in terms of providing you the power to the sites and usually these tower companies encounter some challenges which limit them from meeting the timeliness that we set for them. So, there are different factors that contribute to delays in a project and also, during implementation itself, the team needs time to wrap up so usually it takes time for the team to get to speed and to start deploying at the right pace. What also causes a major delay is delay in a shipment if the vendor does not provide the right shipping information, it becomes difficult in clearing the items from the port and this could go up to 3 to 4 weeks as well. Also, poor communication skills, lack of top management support, non-availability of project contractors, delay in seeking budget approval, delay from the vendor side in importing the hardware into the country. **#D3.** Time overrun is actually quite a problem, topmost among these are for example of issuing of POs, getting the site ready for installations, sometime availability of the resources in the country to also meet the rollout demand. In a case of PO for example, this delays the start of the entire project itself and once the start time is delayed is also impact on time window within which to finish the project and get some returns within the financial year. In terms of the site being ready for installations, this also has a big impact on the cell site rollout because the site is not ready for installations,	nal processes, site permits by the communities, organisational cultures (Transcript 1,3:184)	shortfalls that you have to do rework, labour dispute, (Transcript 3, 4:150) #D5. delay in obtaining regulatory approvals, not able to deliver equipment on time, approval from the municipal assembly (Transcript 2,5:171)	processes, etc., RFI (Transcript 4, 1:117)	dispute (Transcript 5, 6:101) #D2. Delay in clearing the hardware from the port, delays in preparing the sites by the tower companies (Transcript 6, 2:96)	contract management; Poor monitoring and control; Poor scoping; Internal approval processes; Poor communication skills; Non-availability of project contractors; Delay in seeking budget approval; Delay from the vendor side in importing the hardware into the country; Delay in clearing the hardware from the port; Delays in preparing the sites by the tower companies; late issuing of Pos; Too many parties involved in the project; Inaccurate time & cost estimate; Inadequate resources; Lack of experienced contractors; Late delivery of materials; Issues of project funding; Internal organisational processes; Site permits by the communities; Organisational cultures; Poor planning; Inaccurate time	2,5:171 Transcript 3, 4:150 Transcript 4, 1:117 Transcript 5, 6:101 Transcript 6, 2:96 Transcript 1,3:20-23 Transcript 2,5:19-20, 22 Transcript 3, 4:14 Transcript 4, 1:12-13,16 Transcript 5, 6:12-13, 17 Transcript 6, 2:13-14, 17-18

		obviously, the equipment will sit in the warehouse until the site is ready. We have delays because there are many parties involved in getting the site ready, i.e. telco has to liaise with the tower company, which would then l liaise with its subcontractors and related city authorities to then get site ready and constructed in terms of the equipment arrival. When it comes to qualified installations teams also; as a small country, there resources are not infinite. So, there is a finite number of qualified installation resources. Obviously, the more team you have, the more progress, you can make in a day. too many parties involved in the project, inaccurate time & cost estimate, inadequate resources, poor scoping, lack of experienced contractors, late delivery of materials, issues of project funding, internal organisational processes, site permits by the communities, organisational cultures. **#D4**. Poor planning; inaccurate time and cost estimate; poor scoping, contract management not done well, project funding (e.g. a vendor not receiving a PO, if you don't fund the project from the vendor side because you didn't have the money available and that end up affecting the time you take to deliver the work), too many quality shortfalls that you have to do rework, labour dispute (within the project team and the community); project manager's competency, lack of communication skills. For site rollout generally, you can easily outrun your schedule, and this is largely a case where the objective or the plan you had from start, you have not met it due to peculiar constraints that you encountered during the implementation. **#D5**. Most often, delays in rollouts are due to delay in material delivery since telecom equipment are not manufactured in-country so we have to import them, there is also delay in physical structures: so, the towercos would have to ready the site for integration which we termed again as RFI (integration as we are installing the telecom equipment on site) So, if the towercos have difficulty dealing with Landlords, getting contracts out to Landlords, it would cause delays in projects, then transmission and radio frequency plan readiness, site permit acquisition from the regulatory, district assemblies, inaccurate time estimate, Inadequate resources, over-specification, poor site management and supervision, land dispute,					and cost estimate; Contract management not done well; Too many quality shortfalls that you have to do rework; Labour dispute (within the project team and the community) etc.	

		lack of top management support, lack of communication skills sometimes, delay in obtaining regulatory approvals, not able to deliver equipment on time, approval from the municipal assembly. There could be delay in obtaining regulatory approvals. There is also a situation where vendor is not able to deliver equipment on time which will impact your implementation timeliness i.e. if you have initially to have planned to rollout in a district on the certain date, by mere fact that the equipment you need to do the rollout are not available, you are not able to meet that timeliness. Aside getting approvals from the regulatory agencies, you also need to get approval from the municipal assembly to deploy within their jurisdictions **#D6**. One of the major factors of site delays is acquisition of that location. Acquisition of that location usually involves (1) getting that a lease for that location and (2) going through the regulatory permit. So, this regulatory permit can bring delays ranging from 1 to 6 months. Poor communication skills, inaccurate time estimate, issues with top management support, late delivery of materials, poor contract management, any form of labour disputes.						
COST OVERRUN	*Understanding project cost overrun*	**#D1.** When you spend more money on the project than its estimated budget, that is cost overrun. **#D2.** This is where scope creep leads to exceeding the project budget. **#D3**. Cost overruns is the additional cost beyond the original budget. **#D4**. Cost overrun is a situation where a cost you have ascribed to your project is less than what you have finally achieved after delivery the project. Thus; you have exceeded the planned cost of the project or budget. **#D5.** Your actual cost is higher than your original budgeted cost	#D3. the additional cost beyond the original budget (Transcript 1,3:110)	#D4. exceeded the planned cost of the project or budget. (Transcript 3, 4:107) #D5. actual cost is higher than your original budgeted cost (Transcript 2,5:116)	#D1. spend more money on the project than its estimated budget (Transcript 4, 1:85)	#D2. where scope creep leads to exceeding the project budge (Transcript 6, 2:79)	Cost overrun can be defined as spending more money on the project than its estimated budget.	Transcript 1,3:56 Transcript 2,5:67 Transcript 3, 4:59-60 Transcript 4, 1:57 Transcript 5, 6:48 Transcript 6, 2:47
	Frequency and approximation of cost	**#D1**. Sometimes **#D2**. Sometimes **#D3.** it rarely goes over budget	#D3. rarely (Transcript 1,3:31)	#D4. sometimes (Transcript 3, 4:30) #D5. rarely,	#D1. sometimes (Transcript 4, 1:27)	#D6. sometimes (Transcript 5, 6:23)	Site project goes over budget sometimes	Transcript 1,3:31 Transcript 2,5:33 Transcript 3,

	overrun occurrence	**#D4**. Sometimes **#D5.** Rarely, we try to always work within our schedule and budget. So, in terms of resources, you would want to get competent resources to do your rollout for you. **#D6.** Sometimes		(Transcript 2,5:33)		#D2. sometimes (Transcript 6, 2:25)		4:30 Transcript 4, 1:27 Transcript 5, 6:23 Transcript 6, 2:25
	Description of project cost overrun impact on delivery of site projects	**#D1.** There was instance it happened but because we realised it was the fault of the customer, we raised to the customer and the customer had to pay for the difference There was instance it happened but because we realised it was the fault of the customer, we raised to the customer and the customer had to pay for the difference. It impacts the schedule of the project and you need to increase resources in order to speed up the project to be able to deliver within the timeliness **#D2**. Every site must pay for itself, so if there is budget overrun and the business case proves positive, we still go ahead. Forex impact can cause a budget overrun. So, you start the project which has 6 months duration, at the start the cedis to dollar was Ghs4.0 and in the middle of the project cedis to a dollar becomes Ghc 4.2 and this is a multimillion project, so 2% forex has a significant impact on the financial burden of the project. **#D3.** This impacts the quality of the projects. In cases where the cost overrun is accepted, this impacts the profit rate of the supplier as well. Telcos, as mentioned earlier are mostly shielded from cost overrun due to business model, they are running with the suppliers. When additional budget is applied for, it means some part of the initial budget is gone unrealised and for that matter part of the value is being lost **#D4.** It affects service quality, availability, capacity and even the revenues that the business itself has to make **#D5**. With cost overrun, you would not able to meet project objective because you are not able to fund it. **#D6.** A clear example I had is the project we needed to deliver within 6 months and based on some pre-discussions and preplanning, we realised that based on the timeliness we were working in and based on the budget that we had already agreed upon, to beat the timeliness, we needed to bring in some type of connectors and there was a discussion with the project	#D3. Telcos shielded from cost overrun due to business model (Transcript 1,3:32,37)	#D4. affects service quality, availability, capacity and even the revenues that the business (Transcript 3, 4:31-32) #D5. not able to meet project objective (Transcript 2,5:36-37)	#D1. impacts the schedule of the project (Transcript 4, 1:30)	#D6. spend more to be able to deliver (Transcript 5, 6:25-26) #D2. Every site must pay for itself (Transcript 6, 2:28)	Cost overrun (over budget) ultimately has financial impacts with respect to revenue realisation by the operator and profit rate of the supplier and service quality impact as well.	Transcript 1,3:32,37 Transcript 2,5:36-37 Transcript 3, 4:31-32 Transcript 4, 1:30 Transcript 5, 6:25-26 Transcript 6, 2:28

		sponsor and because we didn't want to miss the timeliness, we had to exceed the budget by somewhere around $100K. So, we had to bring prefabricated connectors to be able meet a certain installation requirement on site.						
	Outline the factors that cause project cost overrun	**#D1**. These factors also involve poor cost estimation, inexperienced contractors, schedule delays, mistake and errors in design **#D2.** Forex impact can cause a budget overrun. So, you start the project which has 6 months duration, at the start the cedis to dollar was Ghs4.0 and in the middle of the project cedis to a dollar becomes Ghc 4.2 and this is a multimillion project, so 2% forex has a significant impact on the financial burden of the project. Limited engagement from project stakeholders, Lack of top management support, Poor stakeholder coordination, Forex exchange or exchange rate, Inflation **#D3.** lack of experience of Contractors, mistakes and errors in design, requirement changes, schedule delay, inadequate planning and scheduling, supplier is unable to commit adequate qualified resources to the project to control the impact on financial performance **#D4**. Inaccurate time and cost estimate, poor stakeholder management, Inadequate planning and scheduling, design errors, changes in materials cost, scope changes or changes in requirements, Project manager's competency, Lack of communication skills, **#D5**. Inadequate planning, competencies of project resources (resources ability to estimate),Inadequate planning, competencies of project resources, poor cost estimates, Gold plating or over-specification, Fluctuation of prices of material, High inflation & interest rates, Labour disputes/work stoppage, Taken insufficient information from end-users (requirement gathering), Unstable organisational environment, Lack of communication skills by which stakeholders can communicate, poor supervision and inspections. **#D6**. Lack of Communication skills, Poor contract management, Lack of experience, Mistakes and errors of design.	#D3. the suppliers are made to bear the risk and the cost (Transcript 1,3:185)	#D4. Inaccurate time and cost estimate, poor stakeholder management , (Transcript 3, 4:151) #D5. Inadequate planning, competencies of project resources (resources ability to estimate) (Transcript 2,5:172)	#D1. Poor cost estimation, schedule delays, etc. (Transcript 4, 1:116)	#D6. Lack of Communication skills, Poor contract management (Transcript 5, 6:102) #D2. Limited engagement from project stakeholders, Lack of top management support (Transcript 6, 2:97)	Poor cost estimation; Inexperienced contractors; Schedule delays; Mistake and errors in design; Limited engagement from project stakeholders; Supplier is unable to commit adequate qualified resources to the project to control the impact on financial performance; Lack of top management support; Poor stakeholder coordination; Forex exchange or exchange rate; Inflation; Lack of experience of Contractors; Requirement changes; Schedule delay; Inadequate planning and scheduling; etc.	Transcript 1,3:185 Transcript 2,5:172 Transcript 3, 4:151 Transcript 4, 1:116 Transcript 5, 6:102 Transcript 6, 2:97 Transcript 1,3:30 Transcript 2,5:32 Transcript 3, 4:25, 27 Transcript 4, 1:25, 27 Transcript 5, 6:22, 24 Transcript 6, 2:23

POOR QUALITY	*Description of quality metrics in measuring site projects*	**#D1.** From the physical installations: you check if cable bending radius is accurate or wrong, installations quality, cleanliness of the site, cable management, unbolting cabinets on the slabs. KPIs from the customer: data throughput should say 5MB, availability of site, quality of the service for instance signalling, clarity of voice calls, call drops etc. Thus; customer is always looking at for the availability, data throughput, call quality etc. for them to satisfy their customers. **#D2.** There is list of acceptance criteria that we agree with the vendors and the 80% of the acceptance criteria hinges on network quality KPIs. So, from a physical inspection: does it meet the right physical quality from the network point of view, is it meeting all the network KPIs that enhances right user experience. For Fourth Carrier- 3G sites, you need to make sure the user throughput is at the right levels or at least achieving close to 90% theoretical values and also ensure all the radio access quality KPIs are adhere to. So, these are standard network KPIs that you look out for to be able to check to make sure that they all met before you clear the site fully on. **#D3.** The model adopted by most operators is an SLA model: where the metrics for quality is based on the given or meeting certain Key performance Indices (KPI). This also goes to the cell level and includes cell availability, call setup times, cell data throughput, MOS (for voice quality), handover success rate among others. Physical quality checks are also conducted to check the quality of installation and materials used such as RF/microwave brackets and poles to check its galvanisation, bolts and nuts, check for rusting and so on and so forth. These are some of the metrics used to measure quality of cell site project. **#D4.** On regulatory side; there are metrics of network coverage you need to meet: service availability & quality; Call/network Carrying Capacity; latency or call setup time. For data access or service; data quality or throughput, environmental impact assessment. There are standards you need to adhere to ensure you don't endanger the lives of people who are within the vicinity where the site is located. **#D5**. In measuring or accepting cell site that has gone live; we look at availability. The site should be available	#D3. cell availability, call setup times, cell data throughput, MOS (for voice quality), handover success rate among others, physical quality checks, installation and materials used such as RF/microwave etc. (Transcript 1,3:38)	**#D4**… service availability & quality; Call/network Carrying Capacity; latency or call setup time (Transcript 3, 4:34-36) #D5. availability, the speed: the download and upload speed, Customers should be able to get their signal on this means service is available etc. (Transcript 2,5:41-46)	#D1. physical installations : cleanliness of the site, cable manageme nt, unbolting cabinets on the slabs etc., (Transcript 4, 1:32-33)	#D6. Availability of the service, accessibility of the service, retainability of the service etc. (Transcript 5, 6:28-29) #D2. is it meeting all the network KPIs that enhances right user experience? (Transcript 6, 2:29-30)	Quality metrics of measuring Cell Sites rollout project can be grouped under two main areas: 1. Physical Structural Installation (PSI) Metrics accuracy of cable bending radius cleanliness of the site, cable management unbolting cabinets on the slabs quality of installation and materials RF/microwave brackets and poles galvanisation bolts and nuts check for rusting tower and equipment well installed proper health and safety requirement the power requirement 2. Network Performance/Regulatory (NPR) Metrics	Transcript 1,3:38 Transcript 2,5:41-46 Transcript 3, 4:34-36 Transcript 4, 1:32-33 Transcript 5, 6:28-29 Transcript 6, 2:29-30

		for the subscribers to be able to initiate a call on. There is throughput benchmark we give to the vendors to meet. The speed: the download and upload speed, Customers should be able to get their signal on this means service is available, Voice clarity: test calls will be done to ensure that the voice is clear, both the receiver and the sender are able to hear from each other there are no cracking sounds in the communication. After a cell site project is done, there are drive tests that are conducted to measure the signal levels, user throughputs, call clarity, call duration to ensure that we don't have drop calls due to signal loss. And then handover as well: handover the network is dimensioned in location area codes or latches as we termed them. So, if you move from one latch to the other, there is supposed to be some form of handover to the receiving latch. If the right definition is done the call will be dropped. **#D6**. In terms of service quality of a project, there two main broad ways with respect to cell site rollout: One is on the physical structural installations of the cell sites and performance impact of the project. On the Physical Structural bit of the project, we need to make sure the tower is well installed, proper health and safety requirement, we need to make sure the equipment is well installed, the power requirement is all met. With the Performance impact bit, every cell site has a target. It is supposed to meet certain coverage and capacity. In this, there are service KPIs that need to be met. These are usually availability of the service, accessibility of the service, retainability of the service etc.					a. Availability of the service Call/network Carrying Capacity quality of signalling or network reception availability of site data experience, receiving latching onto the network b. Accessibility of the service data throughput clarity of voice calls call drops call setup times the speed for the download and upload, latency signal loss c. Retainability of the service Ability to continuously use the service all the time	
	Understanding project poor quality in site project	**#D1**. Poor quality is when an installation of cell site falls below the standard **#D2.** Site is delivered does not meet all the set service and physical KPIs.	#D3. If project does not meet its specifications	#D4. not fit for purpose. (Transcript 3, 4:122) #D5.	#D1. cell site falls below the standard (Transcript 4, 1:94)	#D2. does not meet all the set service and physical KPIs	Poor quality in site project can be defined as a situation whereby the outcome of	Transcript 1,3:120 Transcript 2,5:134

		#D3. If project does not meet its specifications and in some extreme case it can be termed as unfit for its intended purpose. **#D4.** Project quality is termed as poor when the characteristics or the purpose for which the project is being delivered are not met. Thus; your project in the end is not fit for purpose. **#D5.** Poor quality of a project is the extent to which the outcome of the project does not meet specifications and it is unfit for purpose.	(Transcript 1,3:120)	(Transcript 2,5:134)		(Transcript 6, 2:85)	project does not meet the physical installation and the network performance KPIs.	Transcript 3, 4:122 Transcript 4, 1:94 Transcript 6, 2:85
	Frequency and approximation of poor quality occurrence	**#D1**. there was an instance it happened but because we realised it was the fault of the customer, we raised to the customer **#D2**. it rarely happens **#D3**. Sometimes **#D4.** For quality issues, we rarely experience this because partly the regulatory is the benchmark. So, most of the time, anything you are bringing in or even to get the permit to implement requires you to meet the basic quality requirements. So, issues of quality is a bit rare compared to other 2 constraints of schedule and cost **#D5**. Sometimes: hence the need for drive test to ensure key performance indicators are met. Radio optimisation is done post rollouts to ensure this. **#D6.** Usually happens rarely	#D3. Sometimes, (Transcript 1,3:40)	#D4. For quality issues, we rarely experience this because partly the regulatory is the benchmark. (Transcript 3, 4:37) #D5. Sometimes, (Transcript 2,5:48)	#D1. it was the fault of the customer, we raised to the customer (Transcript 4, 1:37)	#D6. usually happens rarely (Transcript 5, 6:30) #D2. it rarely happens (Transcript 6, 2:31)	Poor quality does happen sometimes during Cell site rollout project., however, the Regulator serves as a benchmark for rectifying quality issues because of there is fines slap on the telcos on quality issues.	Transcript 1,3:40 Transcript 2,5:48 Transcript 3, 4:37 Transcript 4, 1:37 Transcript 5, 6:30 Transcript 6, 2:31
	Description of project poor quality impact on delivery of site projects	**#D2.** this is part of the delays that comes with the project. So, it delays the go live date and it is just the matter of going back to fix them. **#D3.** Poor quality will increase the cost as additional site visits are required to rectify quality issues. This also leads to poor customer experience. Poor quality in some cases lead to coverage gaps which can lead to revenue losses for the Telcos. If you look at the extreme end, poor quality installation can lead to serious injury or even death from falling antennas or loose bolts. **#D4.** In the event I have delivered the project to the acceptance stage which is almost at the closure stage in the life cycle and by checking the benchmark, we realise that the service we are delivering from that site	#D3. Poor quality will increase the cost as additional site visits are required to rectify quality issues. (Transcript 1,3:42)	#D4. then customers confident and loyalty is eroded; could lead me to fines or customer dissatisfaction and impact on my corporate image (Transcript 3, 4:38-39)		#D6. There is a time impact and cost impact that would affect you if quality is impacted, it means that the acceptance of the project would delay (Transcript 5, 6:31-32) #D2. it delays the go live	Poor quality brings about rework which increases the project cost, leads to poor customer experience, Regulatory fines, customer dissatisfaction, impact on corporate image, pushing the go live date farther, and at	Transcript 1,3:42 Transcript 2,5:50 Transcript 3, 4:38-39 Transcript 5, 6:31-32 Transcript 6, 2:32

		is poor, it means we have to do a rework. So, the cost of the rework is a negative for the investment we are making so that equally affect the value we are delivering. Then there are issues of customer complaints: we are delivering the site to serve the needs of the customers. So, if the customers who you are serving with a new site you have rollout already start having issues, then customers confident and loyalty is eroded. So, the value you again gain from that site is equally impacted by the poor quality of work that you have delivered. Then in terms of infrastructure itself: if I bring in poor quality equipment probably to cut down my initial cost. Rolling that out and having quality issues, straight away could lead me to regulatory fines or customer dissatisfaction and impact on my corporate image. So, it cuts across. **#D5.** Poor quality brings about rework which increases the project cost, it leads to loss of customer confident and could result in loss of revenues and customers. **#D6.** There is a time impact and cost impact that would affect you if quality is impacted in any of your project. If there is any quality that is degraded in the delivery of the project, what it means that the acceptance of the project would delay and if it delays one the project timeliness would exceed and then you need to retain resources to be able to fix whatever quality issues that come up.		#D5. could result in loss of revenues and customers (Transcript 2,5:50)		date and it is just the matter of going back to fix them. (Transcript 6, 2:32)	the extreme end, poor quality installation can lead to serious injury or even death from falling antennas or loose bolts, etc.	
	Outline the factors that cause poor quality	**#D1.** Poor supervision and site management, Inexperienced project team and engineers, lack of quality assurance and control, Lack of communication skills **#D2.** Contractor incompetence, Unclear KPIs, Pressure to deliver the project, Climate condition at the site **#D3**. Poor communication skills, Lack of quality assurance and control, Incompetence subcontractor or contractors, Scope creeping, Poor supervision, Hostile socio-economic environment, Conflict among project team, Poor working relationship among Team, Lack of Project Manager knowledge, Lack of quality focus **#D4.** Limited information, scope creeps, Poor supervision, Lack of quality assurance and control, gold plating (is a situation where you go beyond the	#D3. Poor working relationship among Team, Lack of Project Manager knowledge, Hostile socio-economic environment (Transcript 1,3:186)	#D4. Changing quality needs during project implementation, etc. (Transcript 3, 4:152) #D5. Unsupportive organisational culture, Poor deliverable quality, etc.	#D1. Inexperienced project team and engineers, lack of quality assurance and control, etc. (Transcript 4, 1:115)	#D6. faulty project conceptualisation, conflict among project team, Lack of project management Knowledge (Transcript 5, 6:103) #D2. Unclear KPIs, Pressure to	Poor supervision and site management; Inexperienced project team and engineers; Lack of quality assurance and control; Lack of communication skills; Contractor incompetence; Unclear KPIs; Pressure to deliver the project; Climate	Transcript 1,3:186 Transcript 2,5:173 Transcript 3, 4:152 Transcript 4, 1:115 Transcript 5, 6:103 Transcript 6, 2:98

		quality plan you have had, thus; deciding it to make the outcome too beautiful than planned), Changing quality needs during project implementation, **#D5.** Lack of quality assurance and control, Poor scope alignment, poor monitoring and control, Unsupportive organisational culture, Poor deliverable quality, Conflicting requirement, Unclear requirements (based on project management recommendations, requirements are supposed to be precise and measurable, so if requirements are not measurable then it becomes difficult to determine whether the quality metrics are met or not), Poor client-vendor relationship, Lack of understanding of end-user requirement, Lack of a quality focus, Lack of communication skills, Poor supervision and site management #D6. Lack of quality assurance and control, Scope creeping, faulty project conceptualisation, conflict among project team, Lack of project management Knowle dement, Lack of quality focus		(Transcript 2,5:173)		deliver the project, etc. (Transcript 6, 2:98)	condition at the site Lack of quality assurance and control; Incompetence subcontractor or contractors; Scope creeping; Hostile socio-economic environment; Conflict among project team; Poor working relationship among Poor monitoring and control; Unsupportive organisational culture; Poor deliverable quality; Conflicting requirement etc.	
OUT OF SCOPE	*Understanding out of scope of work.*	**#D1.** Out of scope is when an activity is being done which is not part of the initial scope definition. Out of scope comes from the customer and such change request must be flagged as out of scope and additional resources need to be demanded so it does not eat into your budget **#D2.** An occurrence of scope creep constitutes out of scope **#D3.** This is when the project outcome is not what is expected **#D4.** The outcome of the deliverables is not exactly what I set up to do	#D3. project outcome is not what is expected (Transcript 1,3:138)	#D4. outcome of the deliverables is not exactly what I set up to do (Transcript 3, 4:130)	#D1. activity is being done which is not part of the initial scope (Transcript 4, 1:100)	#D2. scope creep constitutes out of scope (Transcript 6, 2:89)	Out of scope in cell site rollout can be defined as scope creep, thus; an inclusion of project activities which are not part of the initial scope definition.	Transcript 1,3:138 Transcript 3, 4:130 Transcript 4, 1:10 Transcript 6, 2:89
	Frequency of out of scope	**#D2** it rarely happens **#D3.** Out of scope happens sometimes **#D4.** Largely never or rarely happens	#D3. Out of scope happens sometimes	#D4. Largely never or rarely happens		#D6. sometimes (Transcript 5, 6: 35)	Out of scope rarely happens during Cell site rollout project	Transcript 1,3:45 Transcript 2,5:53 Transcript 3,

	occurrence in site projects	**#D5**. It rarely happens **#D6**. sometimes	(Transcript 1,3:45)	(Transcript 3, 4:42) #D5. It rarely happens (Transcript 2,5:53)		#D2. it rarely happens (Transcript 6, 2:35)		4:42 Transcript 5, 6:35 Transcript 6, 2:35
	Description of out of scope of work impact on delivery of site projects	**#D1**. It increases the planned activities for that period because of the additional work and will impact the budget and the overall delivery timeliness. …If I don't get customer's buy-in, I don't affect the change and only execute what we agreed initially in scope. Refusal to pay extra money to cover the additional work is ignored. However, if the change request (out of scope) does not impact project budget or schedule, then it is considered in the implementation and it is done for free for the customer. **#D2**. It can derail the plan so if there is any scope creep it increases the cost. And now the new cost does not make the site fit or pounce the business case, then it becomes challenging, the site would not be done. **#D3**. It will increase cost, also increase the schedule as well. **#D4.** If there are slips in the scope, most of the time it would rather be a scope creep (something that you have not anticipated when you were planning has come in while you are on site and you would have to take care of that else the work cannot go on). Scope creep is usually not out of scope but an expansion of scope and in most cases, they are act of nature or act of God (so there are situations you cannot work around) or else, your quality or the earned value would be impacted. **#D5.** The rework comes in and that is going to impact your schedule and it is going to hit you hard on your books because the cost could be huge **#D6.** With every project, there are a list of activities that are designated and anytime an activity that has not been initially planned and agreed upon comes up, we define it as going out of scope. It prolongs the delivery timeliness and sometimes, there is cost implication that come in	#D3. It will increase cost (Transcript 1,3:46)	#D4. it would rather be a scope creep (Transcript 3, 4:43-44) #D5. rework comes in and that is going to impact your schedule (Transcript 2,5:54-55)	#D1. the additional work will impact the budget and the overall delivery timeliness. (Transcript 4, 1:44)	#D6. It prolongs the delivery timeliness (Transcript 5, 6:36) #D2. It can derail the plan so if there is any scope creep it increases the cost (Transcript 6, 2:36).	Out of scope may increase project cost, impact quality, and prolong delivery timeliness resulting value loss.	Transcript 1,3:46 Transcript 2,5:54-55 Transcript 3, 4:43-44 Transcript 4, 1:44 Transcript 5, 6:36 Transcript 6, 2:36

	Outline the factors that cause out of scope of work	**#D1.** Out of scope comes from the customer and such change request must be flagged as out of scope and additional resources need to be demanded so it does not eat into your budget. Out of scope is for example, a customer said we should undertake LTE rollout with a configuration on the LTE site. So, in the course of the implementation, customer realised that configuration would not help them so increase it. As a good project manager, you need to identify this change as out of scope, meet with the customer and demand extra budget to cater for the change. Also, lack of detailed scope, lack of scope management, over-specification. **#D2.** From experience because we have done this over a long period, we have mastered the trade so there is little or no room for creep because budget is hard to come by so there are instances, we try to deliver more within the said budget. So, there is a zero tolerance in scope creep after many years of rollout sites. Scope creep **#D3**. We go out of scope; this would definitely increase cost and has impact on schedule as well. Lack of detailed scope, lack of stakeholder involvement, poor communication skills, conflicting requirement, over-specification. **#D4**. Most of the time, scope is maintained because that is where the revenue is for instance, in my business case, there is money to be made at a particular location and decide not to cover the location. I am robbing my own self of money. For the scope of work, you must always almost ensure you achieve that. The factors include unclear/ambiguous requirements, Inconsistent process for collecting product requirements in relation to the industry standards, poor scope management, excessive restriction of project budget **#D5.** Out of scope in cell site rollout is essentially what you are delivery is network so rarely do we have a project going out of scope: meaning you can't go beyond delivery a network unless we want to talk about technology here where a scope was to deliver a 2G Network and the vendor decides to deliver a 3G network which rarely happens. Ambiguous scope definition, Lack of stakeholder involvement, Lack of top management support,	#D3. Lack of stakeholder involvement, Poor communication skills (Transcript 1,3:153)	#D4. poor scope management, excessive restriction of project budget (Transcript 3, 4:152) #D5. Non-availability of experienced contractor, Different geographical locations, Poor standard of workmanship (Transcript 2,N 5:174)	#D1. change request must be flagged as out of scope and additional resources need to be demanded so it does not eat into your budget (Transcript 4, 1:114)	#D6. Poor communication skills, Conflicting requirement, (Transcript 5, 6:104) #D2. Scope creep (Transcript 6, 2:99)	Lack of detailed scope; Lack of scope management; Over-specification; Scope creep; Lack of stakeholder involvement; Poor communication skills; Conflicting requirement; Unclear/ambiguous requirements; Inconsistent process for collecting product requirements in relation to the industry standards; Excessive restriction of project budget; Ambiguous scope definition; Lack of stakeholder involvement; Lack of top management support; Inaccurate time and cost estimates, etc.	Transcript 1,3:153 Transcript 2,5:174 Transcript 3, 4:152 Transcript 4, 1:114 Transcript 5, 6:104 Transcript 6, 2:99

		Inaccurate time and cost estimates, Terrain (project environment), quality of telecom equipment, Non-availability of experienced contractor, Different geographical locations, Poor standard of workmanship, Lack of a quality focus, Lack of communication skills, **#D6**. With every project, there are a list of activities that are designated and anytime an activity that has not been initially planned and agreed upon comes up, we define it as going out of scope. Factors include incorrect requirement, over-specification, Poor communication skills, Conflicting requirement, unclear scope definition						
TEAM DISSATISFACTION	*Definition of project team dissatisfaction*	**#D1.** When the project team members are unhappy with the project **#D2.** When project team members are frustrated partly due to lack of earlier engagement **#D3.** When project Team expectations from the projects are not being met **#D4.** Project team dissatisfaction is a situation where the expectation their project team came to the project with are not met **#D5**. Project team members get dissatisfied if their expectations from the project are not being met	#D3. …expectations from the projects are not being met (Transcript 1,3:150)	#D4. expectation their project team came to the project with are not met (Transcript 3, 4:137) #D5. expectations from the project are not being met (Transcript 2,5:157)	#D1. When the project team members are unhappy with the project (Transcript 4, 1:106)	#D2. When project team members are frustrated partly due to lack of earlier engagement (Transcript 6, 2:91)	Team dissatisfaction be explained as a situation where project team members are unhappy as expectations from the projects are not met.	Transcript 1,3:150 Transcript 2,5:157 Transcript 3, 4:137 Transcript 4, 1:106 Transcript 6, 2:91
	Frequency of team dissatisfaction occurrence in site projects	**#D1**. Sometimes **#D2** Sometimes **#D3**. Sometimes **#D4.** Rarely **#D5**. Sometimes **#D6**. It rarely happens	#D3. Sometimes (Transcript 1,3:49)	#D4. Rarely (Transcript 3, 4:51) #D5. Sometimes (Transcript 2,5:59)	#D1. Sometimes Transcript 4, 1:49	#D6. It rarely happens (Transcript 5, 6: 40) #D2. Sometimes (Transcript 6, 2:39)	Team dissatisfaction sometimes happens during Site project	Transcript 1,3:49 Transcript 2,5:59 Transcript 3, 4:51 Transcript 4, 1:49 Transcript 5, 6:40 Transcript 6, 2:39

	Team dissatisfaction effect on site project	**#D1**. If the team members are not paid well, they are overworked, and they don't get over time or any kind of motivation then they become dissatisfied and do the work anyhow. Project team can be dissatisfied when the team has to work with the Backoffice engineers. Team gets to the site and the Backoffice engineer is not available to support them to work. He keeps the Team on site for long hours can become dissatisfied because working at the site is more difficult than being in office. Because in every project you find one or 2 people within the team who are dissatisfied. it can cause your project delay. **#D2**. It creates conflict, which has a risk of affecting either quality of work or causing delays. Within the project team, there is a project manager and number of subject matter experts within the team. The number of subject matter experts are people that sit in my function, so I will speak for the issues that the subject matter experts face during the project. So basically, subject matter experts would prefer an early engagement to be able to allow them time to provide all the support that is needed in the project. So, in absence of early engagement creates sort of frustrations for them because what then happens is that the project manager starts putting a lot of pressure on them to sort of go out their way to meet the straight deadliness which had occurred because of lack of earlier engagement. So, one of the frustrations that subject matter experts within the project would face is lack of earlier engagement which causes a lot stress and a lot of burden on them put in extra working hours to just to meet said deadliness. **#D3**. The quality and schedule are usually impacted as a result of team dissatisfaction. **#D4**. Team dissatisfaction generally affects morale. May not be necessarily the project team itself, because most of the time the project team has a vested interest in the success of the delivery but there are situations where stakeholders like the communities in which you are going to deploy are not just ready to accept that infrastructure coming in. At times, due to low level of education, people feel once you put radio equipment in their vicinity, everybody is going to be impacted with cancer. But stakeholders within the larger community	#D3. ..affects the quality and the schedule of the rollout (Transcript 1,3:50)	#D4. Team dissatisfaction generally affects morale (Transcript 3, 4:52) #D5. …because of repeated visit, they become nostalgic, (Transcript 2,5:60)	#D1. it can cause your project delay (Transcript 4, 1:51)	#D6. you have problem with morale, it can really affect your project timeliness (Transcript 5, 6:41) #D2. affecting either quality of work or causing delays (Transcript 6, 2:40)	Team dissatisfaction can affect team morale and productivity, which may result in poor quality of work, delays, and cost overrun	Transcript 1,3:50 Transcript 2,5:60 Transcript 3, 4:52 Transcript 4, 1:51 Transcript 5, 6:41 Transcript 6, 2:40

		beyond the one who has given you the permit, equally could be dissatisfied with it and you need to manage it. Most of these projects are greenfield, so you move a team to remote areas where there is not even telecom services there to communicate with the families they have left behind. So very serious human sentiments do come in and you need to fall on your personal and human management skills to try to get the team to still Have a team spirit to work with for you. **#D5**. What it does to the team members is because of repeated visit, they become nostalgic, they are unproductive, this affects the schedule because of repeated visit, it affects your cost and team members become exhausted which affects quality of what deliver **#D6.** When there is a team dissatisfaction you have problem with morale, it can really affect your project timeliness ends up leading to delays and slips. Even when sometimes project seems to be missing timeliness, when morale is very high, you are able to push and even go beyond. So anytime, you have problem with morale, it can really affect your project timeliness						
	Outline the factors that cause project team dissatisfaction in cell site rollout project	**#D1**. Politics within the organisation and its negative effect, Different geographical location, Lack of top management support, poor client and vendor relationships **#D2**. Lack of earlier team members engagement, Pressure from Project Manager, Extra working hours, Conflicts among project stakeholders **#D3.** Lack of motivation and monetary rewards, Delay in payment to vendors/supplier/subcontractor, Cumbersome organisational processes, Lack of Communication skills, Too many reworks due to poor quality, Lack of top management support, Politicking among team members **#D4**. Poor client-vendor relationship, Corporate politics with negative effect, Delay in payment to vendors/supplier/subcontractor, Poor management of team motivation and motivational drives, excessive changes to project scope, Poor Communication skills of the Project Manager and Team members, Lack of Project manager's competency	#D3. Politicking among team members (Transcript 1,3:175,199)	#D4. Lack of Project manager's competency (Transcript 3, 4:154) #D5. Lack of top management support, Cumbersome organisational processes, Poor client-vendor relationship (Transcript 2,5:175)	#D1. Politics within the organisation and its negative effect (Transcript 4, 1:113)	#D6. Changes in organisational management and leadership, (Transcript 5, 6:105) #D2. Pressure from Project Manager, Extra working hours, (Transcript 6, 2:100)	Site project team members get dissatisfied during deployment resulting from number of factors such as working overtime, lack of earlier engagement, scope changes, conflict, issues and attacks from the community etc., politics within the organisation and its negative effect, Different	Transcript 1,3:153 Transcript 2,5:174 Transcript 3, 4:152 Transcript 4, 1:114 Transcript 5, 6:105 Transcript 6, 2:100

		#D5. So mostly scope changes that causes dissatisfactions on project team. Lack of clear scope, scope creep, payment of remuneration, unstable organisational environment where functional managers keep going and coming, project manager's incompetence, commitment among project participants, poor client-vendor relationship, different geographical locations (in our global village, we have working in different time zones), labour changes in organisational management and leadership, usual corporate politics and its negative effect, unsupportive organisational culture, lack of top management support, cumbersome organisational processes, poor client-vendor relationship **#D6.** Sometimes, it can happen because of conflict, and misunderstanding. Changes in organisational management and leadership, Organisational politics, Poor client-vendor relationship, Lack of communication skills					geographical location; etc.	

Appendix 4.3: Sources of value leaks

OBJECTIVE 3: EXPLORE THE IMPACT OF DIFFERENT SOURCES OF VALUE LEAKS (STAKEHOLDERS, PROJECT LIFE CYCLE, AND ENVIRONMENT) ON PROJECT PERFORMANCE								
CATEGORISED AREAS	**INTERVIEW GUIDE QUESTIONS**	**KEY QUOTES**	**COMPANY "A" KEY WORDS FROM NARRATIVE**	**COMPANY "B" KEY WORDS FROM NARRATIVE**	**COMPANY "C" KEY WORDS FROM NARRATIVE**	**COMPANY "D" KEY WORDS FROM NARRATIVE**	**ELEMENTS DERIVED FROM NARRATIVES**	**TRANSCRIPT REFERENCES**
VALUE LEAKS CAUSAL FACTORS FROM PROJECT STAKEHOLDER	*Description of project stakeholders*	**#D1.** Cell site rollout stakeholders are anybody involved in the site rollout and if one team fails to perform their duty it affects the rollout **#D2**. …these are people who impact the project or impacted by the project **#D3.** Stakeholders are usually the people who are interested in the project. These stakeholders are the resources not only have interest in outcome of the project, but they are also involved in the delivery of the project **#D4.** Anyone with vested interest in the site rollout is considered a stakeholder **#D5.** These are individuals who impact, influence or are impacted by the project activities and project outcome **#D6**. These are usually external and internal stakeholders that effect the project. So usually direct impacting resources on the project and sometimes external regulatory and environmental causes can also be part of the stakeholders	#D3. Not only interested but are involved in the delivery of the project (Transcript 1,3:72-73)	#D4. Anyone with vested interest in the site rollout (Transcript 3, 4:72) #D5. …who impact, influence or are impacted by the project activities and project outcome Transcript 2,5:80)	#D1. anybody involved in the site rollout (Transcript 4, 1:67)	#D6. external and internal stakeholders that effect the project (Transcript 5, 6:57) #D2 these are people who impact on the project or impacted by the project. (Transcript 6, 2:57)	Cell Site rollout project stakeholders can be explained as anyone with vested interest, who influence or are impacted by project activities and project outcome.	Transcript 1,3:72-73 Transcript 2,5:80 Transcript 3, 4:72 Transcript 4, 1:67 Transcript 5, 6:57 Transcript 6, 2:57
	Outline site projects stakeholders from both internal and external of the company	**#D1.** As a contracting company or vendor; my external stakeholders include the customers and their third parties to the project. For instance, a customer may subcontract part of the project to another third party in addition to what we are doing. That third party is also external to my company and their actions and inactions have direct impact on the	#D3. Internal: supply chain, logistics and procurement, project management, network engineering, finance, HR, External: telco,	#D4. Internal project team from the requesting organisation and the implementing vendor, community, landowners,	#D1 External: customers and their third parties Internal: my team members who play various roles (Transcript 4, 1:68-69)	#D6. project execution team; the project management office, there is the project sponsor that usually the management of the company	**Internal Stakeholders** Commercial Team, Finance Team, Supply Chain, Logistics and Procurement, Project management team, Network/technical	Transcript 1,3:74-75 Transcript 2,5:82-83 Transcript 3, 4:73 Transcript 4,

		project. Internal stakeholders are my team members who play various roles **#D2.** Internal stakeholders: are the commercial team, because they would deliver the output of the project making sure that project delivers on the revenues. Other key stakeholders to be finance team to make sure payment to the vendors are done on time. Supply Chain to make sure we derive the right value from the equipment we purchase from these vendors, so they are involved in negotiating the right values at which we buy these equipment and services from the vendors. External stakeholders: the regulators especially when it comes to permitting and approval of the site; communities Opinion Leaders, who may have some interest where the site should be and how the site would impact the people in the community, Towercos, Vendors etc. **#D3.** From organisational functions such as supply chain, logistics and procurement, project management, network/technical engineering department, finance department, HR, and myriad of critical resources that are needed to deliver the project. The external stakeholders are from the telco, subcontractors. In some projects, the stakeholders are from the governmental or regulatory perspective. **#D4**. Internal stakeholders: project team from the requesting organisation and the implementing vendor. External to the project: Government, which is represented largely by the Regulator, the community in which you are deploying, landlord who is giving you access to land. Site rollout being a social intervention generally affect a larger group. So, on the implementing organisation or a requesting organisation: you look at your stakeholders in terms of the organisation itself. Its staff, the board	subcontractors, governmental or regulator (Transcript 1,3:74-75)	staff, the board, the regulator or the government (Transcript 3, 4:73) #D5. External: tower companies, Regulator, the community, Internal: operations team, transmission planning team (TX), radio frequency planning team (RF) (Transcript 2,5:82-83)		(the CEO, CTO, EXECUTIVES etc. (Transcript 5, 6:58-59) #D2. External stakeholders: the regulators, communities Opinion Leaders, community, Towercos, Vendors etc. (Transcript 6, 2:58-59)	Engineering Team, HR, Project Team Members, Board or the investors, Operations Team, Transmission Planning Team (TX), Radio Frequency Planning Team (RF), Project Management Office, Project Sponsor (the CEO, CTO, EXECUTIVES) **External Stakeholders:** Communities Opinion Leaders, Tower Companies, Vendors, Landlord, The regulatory framework i.e. EPA, and other Government Agencies, NCA, The equipment vendors, Managed service team, Installers, Functional heads, The community, Telcos, Subcontractors	1:68-69 Transcript 5, 6:58-59 Transcript 6, 2:58-59

		or the investors in your organisation, the regulator or the government (because you equally need to live within the dictate of the law that governs your industry, community in which you are going to deploy, the land owners giving portion of land to deploy on. You look at all these stakeholders and find ways to manage their interest **#D5.** The internal stakeholders are basically the operations team, transmission planning team (TX), radio frequency planning team (RF) and then your external stakeholder team would be your tower companies, that you rent cell sites, regulator, the community within which you want to rollout the cell sites. These include your installers, vendors, functional heads within the cell carrier i.e. RF and TX planning heads, operation team members who after the site is rollout the sites are handed to operations team to continue its maintenance **#D6.** Practically, in my company, we have a managed service framework and the managed service team is responsible for the low-level planning once the high-level planning is done by my team. The low-level planning is completed by this external managed service partner. There is also project execution team; the project management office, there is the project sponsor that usually the management of the company (the CEO, CTO, EXECUTIVES etc.). All these are internal stakeholders. The external stakeholders to my company are sometimes are towercos i.e. the ones involved in building the towers and also getting it ready for us to deploy our equipment; the equipment vendors that providing the equipment for us to deploy; the regulatory framework i.e. EPA, and other Government Agencies, NCA that we need to get acquisition from						

	Description of project stakeholders as a source of value leaks during site project deployment	**#D1.** If a party to the project fails to perform their duties, it will impact my timeliness because cell site rollout project is interdependent. Because someone's' deliverables are your input into the project. **#D2.** For internal stakeholders, their input in delivering the project on time is quite key. For example, the supply chain function takes too long a time to negotiate on the project cost, it would cause time overrun and time overrun would lead to value leaks. If the finance team did not make payment to the vendors on time, the vendors might stall the project at some point which could delay the project which would lead to the value leaks. External stakeholders could also cause delays to the project in a sense that they can prevent work from going on in a particular site. There has been instances where people in the community have stalled rollout because of promises that were made to them about road constructions in their community because we put up a site which did not happen, so they block access to the road which prevented the subcontractors from working. So, stakeholders contribute a lot to the success of the project. **#D3.** The stakeholders contribute to for example, time delays in terms of process execution, approval sometime delays from stakeholders, decision making in itself also sometimes delay from project stakeholders. So, project stakeholders can serve as source of value leaks during rollout projects. **#D4**. So let me break this down into the various groups I have earlier identified: On the Government front which is the Regulator: imagine I applied for a permit that is supposed to take 2 weeks and then when is due date, I am told my permit has be delayed by extra 1 week due to internal	#D3. approval sometime delays from stakeholders, (Transcript 1,3:76)	#D4. community unwillingness to allow you to undertake your rollout project end up impacting your schedule because you cannot ignore their claim (Transcript 3, 4:76) #D5. actions or inactions from your project team would have significant impact on your project activities and project outcome Transcript 2,5:85)	#D1. someone's deliverables are your input into the project. (Transcript 4, 1:70)	#D6. Project stakeholders are big factors if not well managed can cause value leaks. *(Transcript 5, 6:60) #D2. If the finance team did not make payment to the vendors on time, the vendors might stall the project at some point which could delay the project which would lead to the value leaks (Transcript 6, 2:60-61)	The actions and inactions of both internal and external stakeholders on site projects could cause value leaks. This therefore makes project stakeholders are as source of value leaks.	Transcript 1,3:76 Transcript 2,5:85 Transcript 3, 4:74-77 Transcript 4, 1:70 Transcript 5, 6:60 Transcript 6, 2:60-61

		issues, straight away my schedule is impacted, and I have lost revenue. For the community, due to the level of education among the people in some areas we deploy the cell sites, they raise issues which are mostly not factual but would indicate their unwillingness to allow you to undertake your rollout project. They end up impacting your schedule because you cannot ignore their claim for reason that they have an interest in the project and you must spend extra time to let them understand the objective of providing services to them. Internal stakeholders: if my project team is dissatisfied and the work they need to do in a day because of the lost morale, they deliver it in 3 days. The value I need to earn on my project has been impacted and I must find cost or increase in schedule to bring it back on **#D5.** Essentially, actions or inactions from your project team would have significant impact on your project activities and project outcome **#D6.** Project stakeholders are big factors if not well managed can cause value leaks. I think the example I made initially was where we had to do a particular project and the towercos were not properly engaged and so gave a timeliness that was not aligned in terms of the initial planning of the project. So usually, all players need to be the same table in the project planning phase.						
	Please indicate which of Team Dissatisfaction causal factors come from Project Stakeholders	**#D1**. poor client and vendor relationships, Lack of top management support **#D2**. Lack of earlier team members engagement, Pressure from Project Manager, Conflicts among project stakeholders **#D3**. Poor communication skills, Lack of motivation and monetary rewards, Lack of top management support	#D3. Lack of motivation and monetary rewards (Transcript 1,3:164, 171, 173)	#D4. Poor management of team motivation and motivational drivers (Transcript 3, 4: 41, 46, 49) #D5. Payment of	#D1. poor client and vendor relationships (Transcript 4, 1:110-111)	#D2. Pressure from Project Manager (Transcript 6, 2:92, 93, 95) #D6. Poor client-vendor relationship	Poor client and vendor relationships, lack of top management support, lack of earlier team members engagement, pressure from project manager,	Transcript 1,3:164, 171, 173 Transcript 2,5:160, 166-169, 98 Transcript 3, 4:134,136 Transcript 4, 1:110-111

		#D4. Poor management of team motivation and motivational drivers, Poor client-vendor relationship **#D5.** Lack of clear scope and scope creep, Lack of top management support, Lack of Communication skills, Payment of remunerations (salaries), Poor client-vendor relationship Changes in organisational management and leadership **#D6.** Poor client-vendor relationship		remunerations (salaries) (Transcript 2,5:160, 166-169, 98)		(Transcript 5, 6: 99)	conflicts among project stakeholders, poor communication skills, lack of motivation and monetary rewards, poor management of team motivation and motivational drivers, lack of clear scope and scope creep, payment of remunerations (salaries), etc.	Transcript 5, 6: 99 Transcript 6, 2:92, 93, 95
	Please indicate which of Time overrun's causal factors come from Project Stakeholder s	**#D1**. Lack of Top Management Support **#D2**. Non-availability of project contractors, delay in seeking budget approval, Lack of top management support, Poor communication skills **#D3**. Late delivery of materials, Lack of experienced contractors **#D4.** Project manager's competency, Land dispute, Too many reworks due to poor quality, Issues of project funding, Poor contract management, Poor scoping, **#D5**. changes in organisational management and leadership, Poor site management and supervision, Over-specification, Inadequate resources, Site permit acquisition **#D6**. Issues with Top management support	#D3. Lack of experienced contractors (Transcript 1,3:97,106)	#D4. Issues of project funding (Transcript 3, 4:99-104) #D5. changes in organisational management and leadership, (Transcript 2,5:107,111-115)	#D1. Lack of Top Management Support (Transcript 4, 1:84)	#D2. delay in seeking budget approval (Transcript 6, 2:69-70, 75-76) #D6. Issues with Top management support (Transcript 5, 6:49, 77)	Lack of top management support, non-availability of project contractors, delay in seeking budget approval, poor communication skills, late delivery of materials, Lack of experienced contractors, project manager's competency, land dispute, too many reworks due to poor quality, issues of project funding, poor contract management	Transcript 1,3: 97, 106 Transcript 2,5: 107,111-115 Transcript 3, 4:99-104 Transcript 4, 1: 84 Transcript 5, 6: 49,77 Transcript 6, 2: 69-70, 75-76)
	Please indicate which of Cost overrun's causal factors come from	**#D1**. Inexperienced contractors **#D2**. Limited engagement from project stakeholders, Lack of top management support, Poor stakeholder coordination **#D3.** lack of experience of contractors	#D3. lack of experience of Contractors (Transcript 1,3: 115, 117)	#D4. poor stakeholder management (Transcript 3, 4:108,115-117,120-121)	#D1. Inexperienced contractors (Transcript 4, 1: 87,91)	#D2. Poor stakeholder coordination (Transcript 6, 2: 81-82)	Inaccurate time and cost estimate, Lack of communication skills, Lack of Project manager's competency,	Transcript 1,3: 115, 117 Transcript 2,5: 119,122,125, 130-133 Transcript 3,

	Project Stakeholders	**#D4**. Inaccurate time and cost estimate, Lack of communication skills, Lack of Project manager's competency, changes in requirements, Inadequate planning and scheduling, poor stakeholder management **#D5**. inexperienced contractors, Inadequate planning and scheduling, incompetent subcontractors, poor cost estimates, competencies of project resources, Inadequate planning **#D6.** Lack of Communication skills, Poor contract management, Lack of experience		#D5. poor cost estimates (Transcript 2,5: 119,122,125,130-133)		#D6. Lack of experience (Transcript 5, 6: 78-80)	changes in requirements, Inadequate planning and scheduling, poor stakeholder management, etc.	4:108,115-117,120-121 Transcript 4, 1: 87,91 Transcript 5, 6: 78-80 Transcript 6, 2: 81-82
	Please indicate which of poor quality's overrun causal factors come from Project Stakeholders	**#D1.** Poor communication skills, Inexperienced project team and engineers **#D2.** Contractor incompetence **#D3**. Poor communication skills, Incompetence of subcontractor or contractors, Conflict among project team **#D4.** Inexperience of project team and engineers, **#D5.** Quality of telecom equipment, Poor standard of workmanship, Inaccurate time and cost estimates, Lack of top management support, **#D6.** Conflicts among project team, Lack of project management knowledge	#D3. Lack of stakeholder involvement (Transcript 1,3:146-147)	#D4. Excessive restriction of project budget, (Transcript 3, 4:134,136)		#D6. Poor communication skills (Transcript 5, 6: 94)	Lack of communication skills, inexperienced project team and engineers, contractor incompetence, lack of stakeholder involvement, excessive restriction of project budget, inconsistent process for collecting product requirements in relation to the industry standards	Transcript 1,3: 131,134,137 Transcript 2,5: 147,151,152, 155-156 Transcript 3, 4: 127 Transcript 4, 1: 98-99 Transcript 5, 6: 85-86 Transcript 6, 2: 86
	Please indicate which of Out of scope's overrun causal factors come from Project Stakeholders	**#D3.** Poor communication skills, Lack of stakeholder involvement **#D4.** Excessive restriction of project budget, Inconsistent process for collecting product requirements in relation to the industry standards **#D6**. Poor communication skills	#D3. Lack of stakeholder involvement (Transcript 1,3:146-147)	#D4. Excessive restriction of project budget, (Transcript 3, 4:134,136)		#D6. Poor communication skills (Transcript 5, 6: 94)	Lack of communication skills, inexperienced project team and engineers, contractor incompetence, lack of stakeholder involvement	Transcript 1,3:146-147 Transcript 3, 4:134,136 Transcript 5, 6: 94

VALUE LEAKS CAUSAL FACTORS FROM PROJECT ENVIRONME NT	*Description of cell site project environment*	**#D1.** Site project environment considers the geographical location of the cell sites and the team, the alignment of regulatory bodies on the project, inflations, the current cost of living etc., have impact on project delivery. **#D2.** This could be the climate that stakeholders in a project sit. **#D3.** There is a number of environments, for example, there is Socio-Political environment. At times, the communities may have a curfew or may have some bans in place at the time of rollout which may impact the rollout. Sometimes, in the execution of projects, there may be changes in management or changes in certain key positions within the contracting telcos organisation which has some kind of impact on the project. **#D4.** With project environment, you would want to look at the physical environment, the people and the geographical concerns. A regulator is equally an environmental factor for me, so I am given a permit to go ahead and rollout because I met all regulatory requirement. I am beginning my rollout and a competitor who already has a site around, has a slip in his metrics and then there is an impact that is determined at same time. So, because of that, the regulator put a blanket ban on all operations of telcos in that locality until the regulator's team comes to reassess the impact. It impacts my cost and affects the satisfaction of my team because they are already on site to work and the work is not happening, but the family is at home. The community: if any of my team members goes out and misbehaves himself and the community is agitated and march up to site, I cannot say I am a project manager, so team go ahead with work whilst the people are mobilising and agitating. Work would stall, and you need to manage the	#D3. Socio-Political environment, external environment of the contracting telco which has some kind of impact on the project. (Transcript 1,3:77)	#D4. the physical environment, the people and the geographical concerns, A regulator is equally an environmental factor (Transcript 3, 4:78-80) #D5. project environment is where project activities are being executed. The community, where the project team members are situated, regulatory policies (Transcript 2,5:86)	#D1. Site project environment considers the geographical location of the sites and the team (Transcript 4, 1:71)	#D6. financial climate of the country, exchange rates, tax policies that are set in place, the regulatory environment, the EPA, the NCA (Transcript 5, 6:61-62) #D2 This could be the climate that stakeholders in a project sit. (Transcript 6, 2:62)	Site project environment can be explained as the elements that could influence the success of the project activities at where it is being carried out. Site project environment can be grouped into 3: Physical Environment (Social)-the actions and inactions of all the people and their locations involved in the project. Financial Environment (Economical)-the financial conditions surrounding the project Regulatory Environment (Government)-the policies and procedures governing rolling out of site project by the Government Regulatory Agencies.	Transcript 1,3:77 Transcript 2,5:86 Transcript 3, 4:78-80 Transcript 4, 1:71 Transcript 5, 6:61-62 Transcript 6, 2:62

		interest of that mob until they are gone else, they may end hurting the team working and work delays further. **#D5.** Essentially, your project environment is an environment where project activities are being executed. The community, where the project team members are situated, regulatory policies, and these are generally termed as enterprise environmental factors **#D6.** I would still describe the project environment as the major external stakeholders, sometimes the financial climate of the country, exchange rates, tax policies that are set in place, the regulatory environment, the EPA, the NCA, the role they play sometimes in getting the project delivered. Also, where the site is being deployed, sometimes, there is chieftaincy issues that might come up, the residential people in the area might also be factors of the environment as well						
	Description of cell site project environmental factors	**#D1.** Geographical location of the sites and the team, the alignment of regulatory bodies on the project, inflations, the current cost of living and its impact on project delivery. **#D2.** One of the factors could be from the external stakeholders, a regulator or an opinion leader can cause the delays in the project and this could be outside the control of the project manager and his team. Another factor that could also cause cost overrun is forex exchange which is also external to the project team **#D3.** The socio-political factors, economic factors, organisational internal factors and contracting internal organisational factors **#D4.** In addition to the regulator, the community, and the geographical location, the act of God or nature are equally issues you could have. For instance, for by the	#D3. the socio-political factors, economic factors, organisational internal factors and contracting internal organisational factors. (Transcript 1,3:82)	#D4. the community, and the geographical location, the act of God or nature are equally issuing you could have. For instance, for by the forecast, (Transcript 3, 4:81-82) #D5. the financial environment where you would want to know impact of your exchange	#D1 Geographical location of the sites and the team, the alignment of regulatory bodies on the project, inflations, the current cost of living and its impact on project delivery. (Transcript 4, 1:72)	#D6. financial climate of the country, exchange rates, tax policies that are set in place, the regulatory environment, the EPA, the NCA (Transcript 5, 6:63) #D2 a regulator or an opinion leader can cause the delays in the project and this could be outside the control of the project manager	The constituents of the project environment are classified into the identified 3 groups: 1**. Physical Environment (Social)** Geographical location of the sites, Virtual team, Opinion Leaders, the community, Experience contractors, organisational internal factors, contracting internal organisational factors, the act of God, Weather	Transcript 1,3:82 Transcript 2,5:87 Transcript 3, 4:81-82 Transcript 4, 1:72 Transcript 5, 6:63 Transcript 6, 2:63

		forecast, I looked at before planning my work, I plan to cast concrete on the 14 day from start of work because looking at the weather forecast there is no expectation of rain and then by the act of God, on the 14-day morning before we get to site, it has started raining and last for the whole day. It would be uncalculated risk, for me as a project manager to tell my team to go. So, I would need postpone the casting of the concrete meaning the casting of the concrete will delay and mounting of the towers will equally delay, mounting of antennas will delay which will deliver that service will delay **#D5.** The physical environment. You also want to look at the financial environment where you would want to know impact of your exchange rate, inflation, the legal and regulatory environment **#D6**. The financial climate of the country, exchange rates, tax policies that are set in place, the regulatory environment, the EPA, the NCA etc., that providing the equipment for us to deploy; the regulatory framework i.e. EPA, and other Government Agencies, NCA that we need to get acquisition from.		rate, inflation, the legal and regulatory environment (Transcript 2,5:87)		and his team..(Transcript 6, 2:63)	climate, Equipment manufacturer, 2. **Financial Environment (Economical)** Inflations, the current cost of living and its impact on project delivery, Forex, the financial climate of the country, exchange rates, financial climate of the country, cost of transporting the equipment **3.Regulatory Environment (Government)** the legal system, tax policies that are set in place, Environmental Protection Agency (EPA), National Communication Authority (NCA)	
	Description of project environment as a source of value leaks during site project deployment	**#D1**. It depends on the geographical location of the cell site rollout. The cost involved in rollout site in the Southern part of the country i.e. Accra would be much less than rolling out same project in the Northern part of the country. It is a source of value leaks because cost of living, cost of transporting the equipment, inflation, etc. can impact your project budget, quality and schedule **#D2**. The impact of these environmental issues on the project is when it is caused a budget overrun, then value is unrealised and when it caused time overrun then value is also lost. So, it depends on the	#D3. curfews imposed by Government as a result of civil unrest, also has direct impact on the delivery where there are time delays (Transcript 1,3:84)	#D4. because the project environment equally introduces value leaks (Transcript 3, 4:83) #D5. they would prevent installations based on the supposed health risk	#D1. It depends on the geographical location of the cell site rollout. (Transcript 4, 1:73)	#D6. it can cause serious time and cost implications to the delivery (Transcript 5, 6:64) #D2. So, it depends on what these causal effects in the environment create in a project.	Project environment can be seen as a source of value leaks during site project because the actions and inactions of all the people involved in the project, the financial conditions surrounding the project and the Government policies and procedures	Transcript 1,3:84 Transcript 2,5:89 Transcript 3, 4:83 Transcript 4, 1:73 Transcript 5, 6:64

		effect of what these causal effects in the environment create in a project. **#D3.** …the entire community banned the installation team from stepping foot on their land and the site up until today has not been delivered. So, this is a case where socio-political environment has very direct impact on the delivery. …curfews imposed by Government as a result of civil unrest, also has direct impact on the delivery where there are time delays, because the window of time to work is limited … changes in the strategies as a result of change of management has direct impact on the project **#D4**. …because the project environment equally introduces value leaks **#D5.** So major thing we have, and it keeps recurring is the perception that cell carriers pose health risk as much as the residents want the service, they would prevent installations based on the supposed health risk within their locations. When such instances come up, you are not able to realise that revenues you want to **#D6.** The environment plays very big role in affecting the delivery of value of the project because anytime any of these examples I made goes out or the wrong side or unpredicted, it can cause serious time and cost implications to the delivery		within their locations (Transcript 2,5:89)		(Transcript 6, 2:64)	governing rolling out site project could cause time overruns, cost overruns and poor quality which are all measures of value leaks.	Transcript 6, 2:64
	Please indicate which of Team Dissatisfaction causal factors come from Project Environment	**#D1**. Politics within the organisation and its negative effect, Different geographical location, **#D3**. Delay in payment to vendors/supplier/subcontractor, Cumbersome organisational processes, Lack of motivation and monetary rewards, Corporate politics with negative effect **#D4**. Lack of Communication skills Project Stakeholders, Delay in payment to vendors/supplier/subcontractor, Corporate	#D3. Lack of motivation and monetary rewards, Corporate politics with negative effect (Transcript 1,3: 165,167, 171-174)	#D4. Delay in payment to vendors/supplier/subcontractor (Transcript 3, 4: 145,147-149) #D5. Cumbersome organisational processes (Transcript 2,5:	#D1. politics within the organisation and its negative effect (Transcript 4, 1:107, 112)	#D6. Changes in organisational management and leadership (Transcript 5, 6: 98,100)	Politics within the organisation and its negative effect, Different geographical location, Delay in payment to vendors/supplier/subcontractor Cumbersome organisational processes, Lack of	Transcript 1,3: 165,167, 171-174 Transcript 2,5: 161,162,165, 167 Transcript 3, 4: 145,147-149

		politics with negative effect, Poor client-vendor relationship **#D5.** Cumbersome organisational processes, Corporate politics with negative effect, Different geographical locations, Lack of Communication skills, **#D6**. Changes in organisational management and leadership, Lack of communication skills		161,162,165,167)			motivation and monetary rewards, Corporate politics with negative effect, Lack of Communication skills, Poor client-vendor relationship, Cumbersome organisational processes, Different geographical locations, Changes in organisational management and leadership, Lack of communication skills	Transcript 4, 1:107, 11 Transcript 5, 6: 98,100)
	Please indicate which of Time overrun's causal factors come from Project Environment	**#D1**. Internal approval processes, **#D2.** Non-availability of project contractors, delays in preparing the sites by the tower companies, delay from the vendor side in importing the hardware into the country, Delay in clearing the hardware from the port **#D3.** internal organisational processes, site permits by the communities, organisational culture **#D4.** Land dispute **#D5.** Delay in material delivery, TX and RF plan readiness, labour dispute, Land dispute, **#D6**. Any form of labour disputes	#D3. site permits by the communities, (Transcript 1,3:114)	#D4. Land dispute, (Transcript 3, 4:100) #D5. TX and RF plan readiness (Transcript 2,5: 96-97, 109-110)	#D1. internal approval processes, (Transcript 4, 1:86	#D2. Lack of top management support (Transcript 6, 2:73,77-78) #D6. Any form of labour disputes (Transcript 5, 6: 74)	Internal approval processes, non-availability of project contractors, delays in preparing the sites by the tower companies, delay from the vendor side in importing the hardware into the country, delay in clearing the hardware from the port, internal organisational processes, site permits by the communities, organisational culture, Land dispute, delay in material delivery, TX and RF plan readiness, labour	Transcript 1,3: 114 Transcript 2,5: 96-97, 109-110 Transcript 3, 4: 100 Transcript 4, 1: 85 Transcript 5, 6: 74 Transcript 6, 2: 73,77-78

							dispute, any form of labour disputes	
	Please indicate which of cost overrun's causal factors come from Project Environment	**#D1**. Inexperienced contractors **#D2**. Forex exchange or exchange rate, Inflation, **#D3**. lack of experience of Contractors **#D4**. changes in materials cost, **#D5.** Lack of communication skills, High inflation & interest rates, Unstable organisational environment, Fluctuation of prices of material	#D3. lack of experience of Contractors (Transcript 1,3:115)	#D4. changes in materials cost, (Transcript 3, 4:118) #D5. Lack of communication skills, (Transcript 2,5:125-129)	#D1. Inexperienced contractors, (Transcript 4, 1:87)	#D2. Forex exchange or exchange rate (Transcript 6, 2:83-84)	Inexperienced contractors, forex exchange or exchange rate, high inflation, lack of experience of contractors, changes in materials cost, lack of communication skills, interest rates, unstable organisational environment, fluctuation of prices of material	Transcript 1,3:115 Transcript 2,5:125-129 Transcript 3, 4:118 Transcript 4, 1:87 Transcript 6, 2:83-84
VALUE LEAKS CAUSAL FACTORS FROM PROJECT LIFE CYCLE	*Outline the phases of cell site project life cycle*	**#D1**. Site rollout follows the project management standards which are initiation, planning, execution (implementation and testing), handing over or closure. **#D3.** It pretty much follows the project management life cycle. It is from initiation, planning, execution (implementation and testing), handing over to closure. **#D4**. There is initiation, planning, execution and closure **#D5**. It follows typical project management life cycle; initiation, planning, execution (implementation) and closure **#D6**. We have initiation, planning, execution (implementation and testing), and closure	#D3. It is from initiation, planning, execution (implementation and testing), handing over to closure (Transcript 1,3:87)	#D4. initiation, planning, execution and closure (Transcript 3, 4:85) #D5. implementation and closure (Transcript 2,5:90-91)	#D1. initiation, planning, execution (implementation and testing), handing over or closure. (Transcript 4, 1:74)	#D6. We have initiation, planning, execution (implementation and testing), and closure (Transcript 5, 6:65)	Site rollout follows the project management standards which are: initiation planning execution (implementation and testing) handing over or closure	Transcript 1,3:87 Transcript 2,5:90-91 Transcript 3, 4:85 Transcript 4, 1:74 Transcript 5, 6:65

	Indicate the phase (s) that effect project performance the most	**#D1.** Planning, if it is not done well then, the project is likely to fail **#D3**. Planning is always very critical, if the planning phase is not done right, a lot of these value leaks issues are pre-empted before commencement of the delivery. So, I will say planning to be the most important phase **#D4**. It is the planning and execution phases, but you can slip most if your plan is not right **#D5**. the planning phase has the greatest impact on the project. If the planning is not properly done, the possibility of the project failing is high **#D6.** I would say the planning phase because usually, if you get the planning right, the execution and everything goes through and meet its value as well	#D3. I will say planning to be the most important phase (Transcript 1,3:88)	#D4. you can slip most if your plan is not right (Transcript 3, 4:87) #D5. the planning phase (Transcript 2,5:92)	#D1 Planning, if it is not done well then, the project is likely to fail (Transcript 4, 1:75)	#D6. if you get the planning right, the execution and everything goes through and meet its value as well (Transcript 5, 6:66)	Planning Phase is considered as the most critical phase in site rollout project followed by execution	Transcript 1,3:88 Transcript 2,5:92 Transcript 3, 4:87 Transcript 4, 1:75 Transcript 5, 6:66
	Description of project life cycle as a source of value leaks during site project deployment	**#D1**. if the activities within the stages of the project life cycle are not performed well, then some value may leak **#D3.** I will say in most cases planning is the problem and the planning with inadequate or incorrect information always poses a big problem to a loss of value. I will say that the highest risk comes from the planning phase; the second is during execution phase where the skill set of the delivering resources are critical. So, in cases where, for example the installation team or the delivery resources are not well trained. Then there are mistakes or lack of quality can also cause leaks in the value for a project **#D4**. Project life cycle is a source of value leaks because i.e. if lessons learnt from previous similar project are not incorporated into my planning, it would affect my execution phase resulting in value leaks	#D3. I will say in most cases planning is the problem and the planning with inadequate or incorrect information always poses a big problem to a loss of value (Transcript 1,3:89)	#D4. Project life cycle is a source of value leaks because i.e if lessons learnt from previous similar project are not incorporated into my planning, it would affect my execution phase resulting in value leaks (Transcript 3, 4:88) #D5. So, if proper planning is not done, the project objective would not be realised	#D1. if the activities within the stages of the project life cycle are not performed well, then some value may leak (Transcript 4, 1:76)	#D6. So, it is really important and can bring a lot of problem to the project if you don't take it seriously. (Transcript 5, 6:67)	Project life cycle is a source of value leaks because if the activities within the stages of the project life cycle are not performed well, then some value may leak. Again, it proper planning is not done, the project objective would be realised	Transcript 1,3:8 Transcript 2,5:93 Transcript 3, 4:88 Transcript 4, 1:76 Transcript 5, 6:67

		#D5. If expert opinion is not sought in preparing the right budget or schedule, project is likely to fail. So, if proper planning is not done, the project objective would be realised **#D6.** Project life cycle is very important because each and every one of the components is not taken seriously or not following the right order, it would have a very big problem. If you into an execution phase without a clear plan, it would have a big problem. If you are executing without monitoring and evaluation as and when at each point in time on the project, you would have a big problem. So, it is really important and can bring a lot of problem to the project if you don't take it seriously.		Transcript 2,5:93)				
	Please indicate which of Team Dissatisfaction causal factors that come from Project life cycle	**#D2**. Lack of earlier team members engagement, Pressure from Project Manager, Extra working hours, **#D3.** Delay in payment to vendors/supplier/subcontractor, Too many reworks due to poor quality **#D4.** Poor management of team motivation and motivational drivers, Excessive changes to project scope, Lack of Communication skills among Project Stakeholders, Delay in payment to vendors/supplier/subcontractor **#D5**. Lack of clear scope and scope creep, Payment of remunerations (salaries), Poor client-vendor relationship	#D3. Pressure from Project Manager, Extra working hours (Transcript 1,3: 165, 172)	#D4. Delay in payment to vendors/supplier/subcontractor (Transcript 3, 4: 141,142,145,147) #D5. Lack of clear scope and scope creep (Transcript 2,5: 160,167-169)		#D2. Lack of earlier team members engagement, (Transcript 6, 2: 92-94	Lack of earlier team members engagement, pressure from Project Manager, extra working hours, delay in payment to vendors/supplier/subcontractor, too many reworks due to poor quality, poor management of team motivation and motivational drivers, excessive changes to project scope, lack of communication skills among project stakeholders, lack of clear scope and scope creep, payment of remunerations (salaries), poor	Transcript 1,3: 165, 172 Transcript 2,5: 160,167-169 Transcript 3, 4: 141,142,145, 147 Transcript 6, 2:92

							client-vendor relationship	
	Please indicate which of Time overrun's causal factors that come from Project life cycle	**#D1.** Poor contract management, Poor scoping, Poor monitoring and control, Lack of Top Management Support, mistake and errors in design, **#D2.** Delay in seeking budget approval, delays in preparing the sites by the tower companies, Poor communication skills, delay from the vendor side in importing the hardware into the country, Delay in clearing the hardware from the port **#D3.** Inadequate resources, Inaccurate time & cost estimate, Issues of project funding, Poor scoping, Inaccurate time & cost estimate, Inadequate resources **#D4.** Lack of communication skills, Too many reworks due to poor quality, Poor contract management, Poor scoping, Inaccurate time and cost estimate, **#D5**. TX and RF plan readiness, Lack of top management support, Lack of communication skills, Over-specification, Inaccurate time estimate, Site permit acquisition **#D6.** Poor communication skills, Inaccurate time estimate, Poor contract management, Late delivery of materials	#D3. Issues of project funding (Transcript 1,3: 94,176-179, 183)	#D4. Lack of communication skills, Too many reworks due to poor quality, (Transcript 3, 4:102-106) #D5. Lack of communication skills, Over-specification, Inaccurate time estimate, Site permit acquisition (Transcript 2,5:97, 105, 108, 112, 114-115	#D1. Lack of Top Management Support, mistake and errors in design, (Transcript 4, 1: 80,82-84, 93)	#D2. delay from the vendor side in importing the hardware into the country, Delay in clearing the hardware from the por (Transcript 6, 2:70,73,75,77-78) #D6. Poor contract management, Late delivery of materials (Transcript 5,6:69-70, 75-76)	Poor contract management, poor scoping, poor monitoring and control, poor/lack of top management support, mistake and errors in design, delay in seeking budget approval, delays in preparing the sites by the tower companies, poor communication skills, delay from the vendor side in importing the hardware into the country, delay in clearing the hardware from the port, inadequate resources, inaccurate time & cost estimate, issues of project funding, poor scoping, too many reworks due to poor quality, TX and RF plan readiness, over-	Transcript 1,3: 94,176-179, 183 Transcript 2,5:97, 105, 108, 112, 114-119 Transcript 3, 4:102-106 Transcript 4, 1: 80,82-84, 93 Transcript 5,6:69-70, 75-76 Transcript 6, 2:70,73,75,77-78)

							specification, site permit acquisition	
	Please indicate which of cost overrun causal factors that come from Project life cycle	**#D1**. Poor cost estimation, schedule delays, mistake and errors in design **#D2.** Limited engagement from project stakeholders, Poor stakeholder coordination, **#D3**. I mistakes and errors in design, schedule delay, Requirement changes, **#D4**. Inaccurate time and cost estimate, changes in requirements, design errors, Inadequate planning and scheduling **#D5**. Inadequate planning and scheduling, Fluctuation of prices of material, incompetent subcontractors, Inadequate planning **#D6**. Lack of Communication skills, Mistakes and errors of design	#D3. schedule delay, (Transcript 1,3:116,117-119)	#D4. Inaccurate time and cost estimate (Transcript 3, 4:108,117,119-120) #D5. Fluctuation of prices of materials (Transcript 2,5:122, 129,130,133)	#D1. Poor cost estimation (Transcript 4, 1:86,89,90,92)	#D2. Limited engagement from project stakeholders (Transcript 6, 2:80,82) #D6. Lack of Communication skills (Transcript 5, 6: 81)	Poor cost estimation, mistake and errors in design, limited engagement from project stakeholders, schedule delays, inaccurate time and cost estimate, changes in requirements, inadequate planning and scheduling, fluctuation of prices of material, incompetent subcontractors, lack of Communication skills, poor stakeholder coordination, etc.	Transcript 1,3: 116,117-119 Transcript 2,5: 122, 129,130,133 Transcript 3, 4: 08,117,119-120 Transcript 4, 1: 86,89,90,92 Transcript 5, 6: 81 Transcript 6, 2: 80,82)
	Please indicate which of out of scope causal factors that come from Project Life cycle	**#D1**. Over-specification, Lack of scope management, Lack of detailed scope **#D2**. Scope creep **#D3**. Lack of detailed scope, conflicting requirement, over-specification **#D4**. Excessive restriction of project budget, Inconsistent process for collecting product requirements in relation to the industry standards, **#D6** Incorrect requirement, over-specification, unclear scope definition, Conflicting requirement, Poor communication skills	#D3. Poor communication skills, Lack of quality assurance and control (Transcript 1,3: 145, 148-149)	#D4. Inexperience of project team and engineers, Gold plating, Lack of quality assurance and control (Transcript 3, 4:1 135-136)	#D1. lack of quality assurance and control, Lack of communication skills (Transcript 4, 1:103-105)	#D2. Unclear KPIs (Transcript 6, 2:90) #D6. faulty project conceptualisatio n (Transcript 5, 6: 88-89, 92-94)	Over-specification, lack of scope management, lack of detailed scope, scope creep, lack of detailed scope, conflicting requirement. excessive restriction of project budget, inconsistent process for collecting product requirements in relation to the	Transcript 1,3: 145, 148-149 Transcript 3, 4: 135-136 Transcript 4, 1: 103-105 Transcript 5, 6: 88-89, 92-94 Transcript 6, 2:90

								industry standards, incorrect requirement, unclear scope definition, poor communication skills	
	Please indicate which of poor quality causal factors that come from Project Life cycle	**#D1**. Poor supervision and site management, lack of quality assurance and control, Lack of communication skills, **#D2**. Unclear KPIs, **#D3**. Poor communication skills, Lack of quality assurance and control, Scope creeping, Poor supervision, **#D4**. Limited information, scope creeps, Inexperience of project team and engineers, Gold plating, Lack of quality assurance and control **#D5**. Ambiguous scope definition, Project Life cycle, Inaccurate time and cost estimates, Lack of top management support **#D6**. Lack of quality assurance and control, Scope creeping, faulty project conceptualisation	#D3. Scope creeping (Transcript 1,3: 131-133, 135)	#D4. Gold plating (Transcript 3, 4: 123, 125, 127-129) #D5. Ambiguous scope definition (Transcript 2,5: 140, 152, 155-156)	#D1. lack of quality assurance and control, (Transcript 4, 1: 95, 97-98)	#D2. Unclear KPIs (Transcript 6, 2:87) #D6. Lack of quality assurance and control (Transcript 5, 6: 82-84)	Poor supervision and site management, lack of quality assurance and control, Lack of communication skills, Limited information, scope creeps, Inexperience of project team and engineers, Gold plating, Lack of quality assurance and control etc.	Transcript 1,3: 131-133, 135 Transcript 2,5: 140, 152, 155-156 Transcript 3, 4: 123, 125, 127-129 Transcript 4, 1: 95, 97-98 Transcript 5, 6: 82-84 Transcript 6, 2:87

APPENDIX 5:
NORMALITY TESTS

APPENDIX 5.1:
SKEWNESS AND KURTOSIS

Descriptive Statistics						
	N	Mean	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
IVL01	187	4.465	-1.502	.178	3.246	.354
IVL02	187	4.305	-.877	.178	1.481	.354
IVL03	187	4.396	-.665	.178	.164	.354
IVL04	187	4.128	-.882	.178	2.443	.354
IVL06	187	4.481	-1.587	.178	2.756	.354
IVL07	187	3.984	-.779	.178	1.153	.354
IVL08	187	3.925	-.406	.178	-.307	.354
IVL09	187	4.321	-1.121	.178	1.105	.354
IVL10	187	3.487	-.011	.178	-.599	.354
IVL11	187	3.984	-.743	.178	.807	.354
IVL12	187	3.805	-.059	.178	-.463	.354
IVL13	187	3.620	-.112	.178	-.558	.354
IVL14	187	3.849	-.435	.178	.122	.354
IVL15	187	3.784	-.282	.178	-.609	.354
IVL16	187	4.005	-.848	.178	1.739	.354
IVL17	187	4.032	-.798	.178	1.557	.354
IVL18	187	3.829	-.727	.178	.802	.354
IVL19	187	3.903	-.570	.178	.216	.354
IVL20	187	3.737	-.285	.178	-.248	.354
IVL21	187	3.254	-.288	.178	-.742	.354
SC01	187	4.615	-1.523	.178	3.224	.354
SC02	187	4.053	-.562	.178	.306	.354
SC03	187	4.230	-.758	.178	-.119	.354
SC04	187	3.989	-.494	.178	-.308	.354
SC05	187	4.453	-1.496	.178	2.442	.354
SC06	187	3.997	-.373	.178	-.264	.354
SC07	187	4.389	-.972	.178	1.186	.354
SC08	187	4.055	-.680	.178	.322	.354
SC09	187	3.738	-.136	.178	-.981	.354
SC10	187	4.025	-.819	.178	.934	.354
SC11	187	4.160	-.717	.178	.288	.354
SC12	187	4.390	-1.185	.178	1.698	.354
SC13	187	3.727	-.404	.178	.229	.354
SC14	187	3.806	-.351	.178	-.278	.354
SC15	187	3.952	-.357	.178	-.216	.354

SC16	187	3.693	.079	.178	-.825	.354
SC17	187	3.912	-.453	.178	-.643	.354
SC18	187	4.337	-.853	.178	.725	.354
SC19	187	3.801	-.348	.178	-.354	.354
SC20	187	3.636	-.167	.178	-.689	.354
SC21	187	3.642	-.189	.178	-.734	.354
SC22	187	3.837	-.457	.178	-.235	.354
SC23	187	4.428	-1.290	.178	1.849	.354
SC24	187	4.263	-.950	.178	.978	.354
SC25	187	4.349	5.334	.178	10.100	.354
TO01	187	3.701	-.659	.178	-.243	.354
TO02	187	3.604	-.348	.178	-.161	.354
TO03	187	3.663	-.365	.178	-.223	.354
TO04	187	4.219	-1.594	.178	2.293	.354
TO05	187	4.219	-1.744	.178	3.387	.354
TO06	187	4.203	-1.647	.178	2.604	.354
TO07	187	4.080	-1.304	.178	1.354	.354
TO08	187	3.237	-.178	.178	-.775	.354
TO09	187	3.769	-1.388	.178	2.228	.354
TO10	187	3.348	-.193	.178	-.164	.354
TO11	187	3.220	-.012	.178	.355	.354
TO12	187	3.141	.243	.178	-.213	.354
TO13	187	3.357	-.186	.178	-.435	.354
TO14	187	3.829	-.929	.178	.760	.354
TO15	187	3.263	-.043	.178	.271	.354
TO16	187	4.112	-1.231	.178	1.286	.354
TO17	187	3.183	.078	.178	-.089	.354
TO18	187	4.027	-1.236	.178	1.580	.354
TO19	187	3.176	-.002	.178	.486	.354
TO20	187	3.134	-.149	.178	.037	.354
TO21	187	3.672	-.582	.178	.168	.354
TO22	187	4.070	-1.115	.178	1.055	.354
TO23	187	4.220	-1.468	.178	1.870	.354
TO24	187	4.274	-1.182	.178	.870	.354
TO25	187	2.820	.317	.178	-.414	.354
TO26	187	3.995	-1.042	.178	.965	.354
TO27	187	3.212	-.156	.178	-.158	.354
TO28	187	3.802	-.978	.178	.576	.354
CO01	187	3.444	.249	.178	-.362	.354
CO02	187	4.128	-.767	.178	1.885	.354
CO03	187	2.973	.405	.178	-.376	.354
CO04	187	3.321	.036	.178	-.140	.354
CO05	187	3.235	.096	.178	-.585	.354
CO06	187	3.749	-.703	.178	.509	.354

CO07	187	4.513	-1.962	.178	4.276	.354
CO08	187	3.920	-1.260	.178	2.884	.354
CO09	187	4.183	-1.086	.178	1.469	.354
CO10	187	4.171	-.659	.178	1.338	.354
CO11	187	3.861	-.638	.178	.233	.354
CO12	187	4.543	-1.604	.178	2.364	.354
CO13	187	4.000	-.519	.178	.743	.354
CO14	187	3.266	.236	.178	.289	.354
CO15	187	3.313	.024	.178	-.381	.354
CO16	187	3.984	-1.105	.178	1.483	.354
CO17	187	3.121	.413	.178	-.248	.354
CO18	187	3.270	-.102	.178	-.493	.354
CO19	187	3.549	-.349	.178	-.328	.354
CO20	187	3.368	-.084	.178	-.467	.354
CO21	187	3.076	.303	.178	-.317	.354
PQ01	187	4.241	-.819	.178	.557	.354
PQ02	187	3.565	.174	.178	-.710	.354
PQ03	187	4.173	-1.229	.178	3.093	.354
PQ04	187	4.043	-.721	.178	1.134	.354
PQ05	187	4.505	-1.716	.178	2.595	.354
PQ06	187	3.335	.175	.178	-.345	.354
PQ07	187	3.403	.069	.178	-.340	.354
PQ08	187	3.280	.527	.178	-.273	.354
PQ09	187	2.925	.449	.178	-.351	.354
PQ10	187	3.335	.116	.178	-.086	.354
PQ11	187	3.225	.186	.178	-.797	.354
PQ12	187	3.411	.050	.178	-.377	.354
PQ13	187	4.310	-1.520	.178	3.262	.354
PQ14	187	3.435	-.068	.178	-.384	.354
PQ15	187	3.403	-.244	.178	-.516	.354
PQ16	187	4.417	-1.345	.178	2.654	.354
PQ17	187	3.481	-.097	.178	-.368	.354
PQ18	187	3.952	-1.072	.178	2.075	.354
PQ19	187	3.649	-.254	.178	-.271	.354
PQ20	187	3.275	.086	.178	-.381	.354
PQ21	187	3.533	-.206	.178	-.246	.354
PQ22	187	3.301	.117	.178	-.543	.354
PQ23	187	3.148	.242	.178	-.152	.354
PQ24	187	3.500	-.335	.178	-.346	.354
PQ25	187	2.530	.511	.178	-.781	.354
UP01	187	4.301	-.982	.178	1.763	.354
UP02	187	4.118	-.991	.178	3.773	.354
UP03	187	3.979	-.725	.178	.085	.354
UP04	187	3.979	-.557	.178	1.081	.354

UP05	187	3.476	.270	.178	-.631	.354
UP06	187	3.465	.043	.178	-.466	.354
UP07	187	4.114	-.944	.178	2.006	.354
UP08	187	2.914	.310	.178	-.539	.354
UP09	187	3.914	-.493	.178	1.414	.354
UP10	187	3.027	.236	.178	-.293	.354
UP11	187	3.850	-.519	.178	-.004	.354
UP12	187	3.457	-.398	.178	-.768	.354
UP13	187	2.621	.552	.178	-.743	.354
UP14	187	2.840	.257	.178	-.964	.354
UP15	187	2.685	.350	.178	-.611	.354
UP16	187	2.741	.353	.178	-.877	.354
TD02	187	3.770	-.515	.178	.011	.354
TD03	187	3.366	.130	.178	-.423	.354
TD04	187	3.989	-.749	.178	.645	.354
TD05	187	3.109	.254	.178	-.479	.354
TD06	187	3.231	.165	.178	-.459	.354
TD07	187	4.027	-.900	.178	1.074	.354
TD08	187	3.237	.085	.178	-.743	.354
TD09	187	3.742	-.505	.178	.036	.354
TD10	187	4.321	-1.843	.178	4.851	.354
TD11	187	3.439	.020	.178	-.512	.354
TD13	187	3.191	.484	.178	-.383	.354
TD14	187	4.183	-1.157	.178	1.807	.354
TD15	187	4.182	-1.162	.178	1.466	.354
TD16	187	4.220	-1.312	.178	1.940	.354
TD17	187	3.789	-.606	.178	.487	.354
TD18	187	3.984	-.863	.178	1.425	.354
TD19	187	4.326	-1.568	.178	3.453	.354
TD20	187	3.989	-.955	.178	2.442	.354
TD21	187	3.299	.081	.178	-.517	.354
PS01	187	4.097	-.806	.178	.472	.354
PS02	187	4.144	-.789	.178	1.345	.354
PS03	187	3.364	.002	.178	-.663	.354
PS04	187	4.000	-.723	.178	.828	.354
PS05	187	4.032	-1.248	.178	4.152	.354
PS06	187	3.310	.286	.178	-.592	.354
PS07	187	3.508	-.189	.178	-.636	.354
PS08	187	3.222	.279	.178	-.333	.354
PS09	187	4.225	-1.004	.178	.833	.354
PS11	187	3.978	-.812	.178	.612	.354
PS12	187	3.749	-.674	.178	.189	.354
PS13	187	3.636	-.398	.178	-.300	.354
PS14	187	3.656	-.304	.178	-.332	.354

PS15	187	3.811	-.699	.178	-.372	.354
PS16	187	3.226	.248	.178	-.579	.354
PS17	187	3.286	.241	.178	-.712	.354
PS18	187	3.511	-.066	.178	-.672	.354
PS19	187	4.086	-.924	.178	.569	.354
PS20	187	3.758	-.332	.178	-.193	.354
PS21	187	4.155	-.786	.178	1.149	.354
PS22	187	3.189	.237	.178	-.684	.354
PS23	187	3.723	-.590	.178	-.087	.354
PS24	187	3.373	.050	.178	-.621	.354
PS25	187	3.845	-.724	.178	-.025	.354
PS26	187	4.016	-1.243	.178	2.576	.354
PS27	187	3.947	-.894	.178	.613	.354
PS28	187	4.048	-.641	.178	.920	.354
PE01	187	4.508	-2.014	.178	5.478	.354
PE02	187	3.941	-.665	.178	.653	.354
PE03	187	3.203	.064	.178	-.413	.354
PE04	187	3.208	.276	.178	-.408	.354
PE05	187	4.412	-1.395	.178	2.615	.354
PE06	187	4.005	-.641	.178	1.584	.354
PE07	187	3.663	-.070	.178	-.712	.354
PE08	187	3.253	.053	.178	-.504	.354
PE09	187	4.194	-1.413	.178	2.266	.354
PE10	187	3.312	.171	.178	-.435	.354
PE11	187	4.273	-1.127	.178	1.225	.354
PE12	187	4.392	-1.544	.178	2.147	.354
PE13	187	3.108	.276	.178	-.505	.354
PE14	187	3.812	-.823	.178	.831	.354
PE15	187	3.389	-.116	.178	-.901	.354
PE16	187	3.503	-.405	.178	-.553	.354
PE17	187	3.530	-.320	.178	-.652	.354
PE18	187	4.348	-1.151	.178	2.033	.354
PE19	187	3.676	-.453	.178	.231	.354
PE20	187	4.242	-1.166	.178	1.680	.354
PE21	187	3.328	-.120	.178	-.779	.354
PE22	187	2.703	.521	.178	-.621	.354
PE23	187	3.249	-.007	.178	-.733	.354
PE24	187	4.468	-1.652	.178	2.862	.354
PE25	187	3.941	-.467	.178	.032	.354
PL01	187	4.257	-1.130	.178	1.485	.354
PL02	187	4.160	-1.067	.178	2.706	.354
PL03	187	4.070	-.793	.178	2.093	.354
PL04	187	3.947	-.826	.178	.715	.354
PL05	187	2.850	.620	.178	-.488	.354

PL06	187	3.876	-.757	.178	.945	.354
PL07	187	3.989	-.884	.178	1.511	.354
PL08	187	4.005	-.818	.178	.923	.354
PL09	187	4.027	-.660	.178	.550	.354
PL10	187	3.425	-.095	.178	-.272	.354
PL11	187	4.215	-1.129	.178	2.586	.354
PL12	187	3.292	.078	.178	-.581	.354
PL15	187	3.213	.024	.178	-.503	.354
PL17	187	3.294	.042	.178	-.874	.354
PL18	187	3.232	.219	.178	-.612	.354
PL19	187	3.815	-.585	.178	.023	.354
PL20	187	3.941	-.728	.178	.797	.354
PL21	187	4.070	-.816	.178	1.410	.354
PL23	187	3.200	.377	.178	-.171	.354
PL24	187	3.397	.162	.178	-.772	.354
PL25	187	3.538	.111	.178	-.767	.354
PL27	187	3.827	-.636	.178	.557	.354
PL28	187	4.016	-.484	.178	.394	.354
PL29	187	4.027	-.518	.178	-.087	.354
PL30	187	4.112	-.661	.178	.444	.354
PL31	187	3.120	.072	.178	-.890	.354
PL32	187	3.194	.234	.178	-.327	.354
PL33	187	3.979	-.965	.178	1.330	.354
PL34	187	3.925	-.875	.178	1.131	.354
PL35	187	3.443	.127	.178	-.602	.354
PL36	187	3.078	.190	.178	-.508	.354
PL37	187	2.950	.252	.178	-.567	.354
Valid N (listwise)	187					

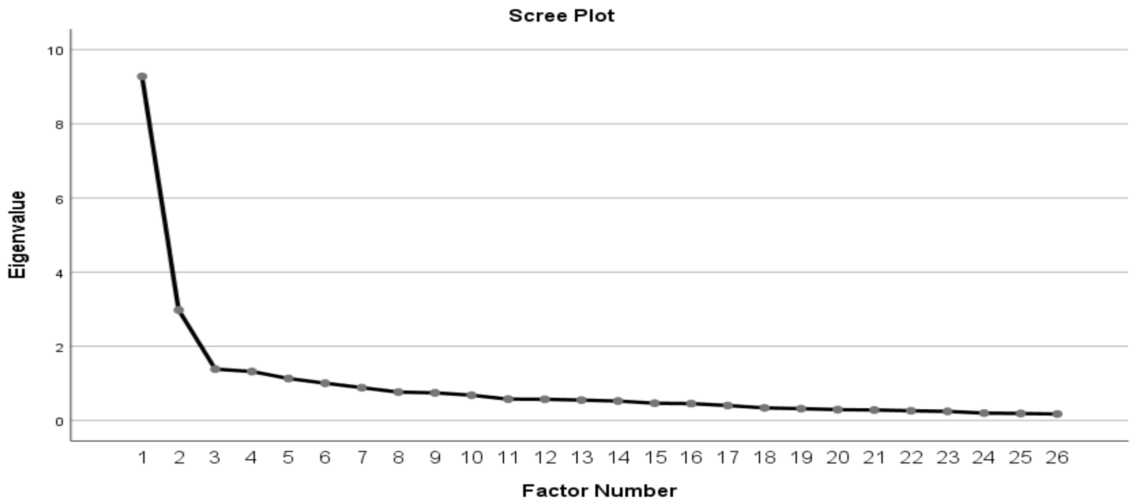
APPENDIX 5.2:
EXPLORATORY FACTOR ANALYSIS

Appendix 5.2a: EFA for the purpose of cell site project

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Factor	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	9.278	35.683	35.683	8.718	33.529	33.529
2	2.978	11.455	47.138	2.467	9.490	43.020
3	1.385	5.325	52.463			
4	1.320	5.075	57.538			
5	1.131	4.350	61.888			
6	1.005	3.864	65.753			
7	.883	3.398	69.150			
8	.765	2.943	72.093			
9	.744	2.863	74.956			
10	.680	2.616	77.572			
11	.576	2.215	79.787			
12	.570	2.193	81.980			
13	.548	2.108	84.088			
14	.524	2.014	86.102			
15	.465	1.787	87.889			
16	.454	1.744	89.634			
17	.401	1.541	91.175			
18	.339	1.305	92.480			
19	.318	1.221	93.701			
20	.292	1.121	94.823			
21	.281	1.081	95.904			
22	.261	1.002	96.906			
23	.243	.933	97.839			
24	.199	.765	98.604			
25	.189	.725	99.329			
26	.174	.671	100.000			

Extraction Method: Maximum Likelihood.



Run MATRIX procedure:

PARALLEL ANALYSIS:

Principal Components & Random Normal Data Generation

Specifications for this Run:

Ncases 187

Nvars 21

Ndatsets 1000

Percent 95

Raw Data Eigenvalues, & Mean & Percentile Random Data Eigenvalues

Root	Raw Data	Means	Prcntyle
1.000000	7.042644	1.653073	1.772427
2.000000	2.467645	1.532258	1.615687
3.000000	1.181994	1.441180	1.508371
4.000000	1.087163	1.365157	1.427062
5.000000	1.026717	1.295033	1.348434
6.000000	.946099	1.233398	1.284580
7.000000	.805439	1.175662	1.220417
8.000000	.758751	1.119488	1.165139
9.000000	.678832	1.066797	1.110357
10.000000	.660105	1.015569	1.056936
11.000000	.579863	.968176	1.008212
12.000000	.517571	.921064	.958919
13.000000	.496130	.875067	.912426
14.000000	.449878	.828768	.869954
15.000000	.430447	.783091	.821772
16.000000	.383341	.738809	.779333
17.000000	.368472	.693906	.732389
18.000000	.330754	.648334	.690457
19.000000	.304992	.602173	.645777
20.000000	.261230	.551473	.596740
21.000000	.221934	.491522	.544421

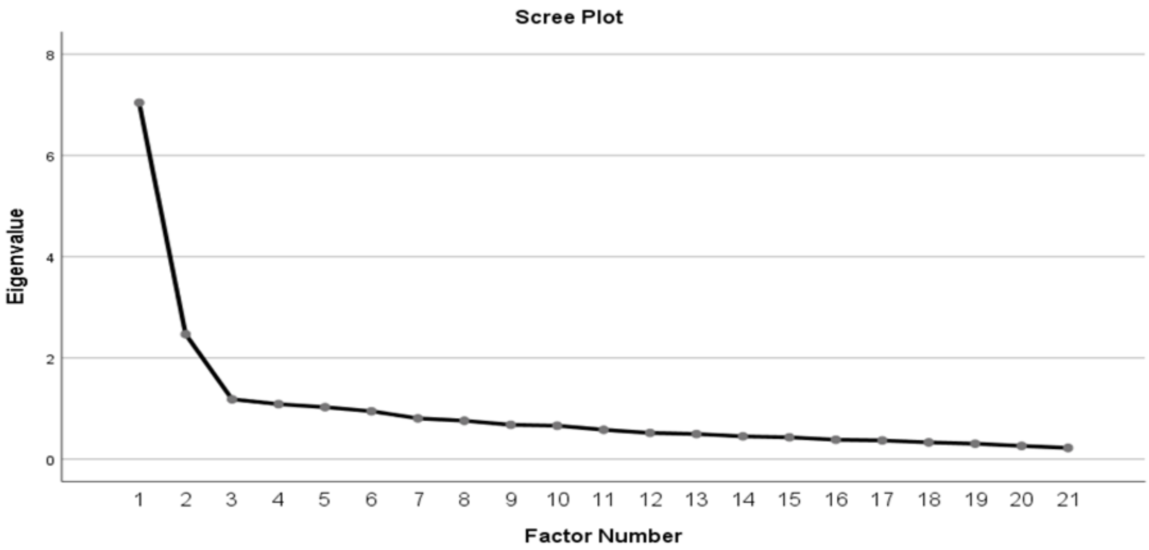
------ END MATRIX -----

Appendix 5.2b: EFA for the for the impacts of value leaks

Total Variance Explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.043	33.536	33.536	4.217	20.082	20.082
2	2.468	11.751	45.287	3.001	14.288	34.370
3	1.182	5.629	50.916	1.971	9.386	43.757
4	1.087	5.177	56.093	.592	2.819	46.575
5	1.027	4.889	60.982	.548	2.612	49.187
6	.946	4.505	65.487			
7	.805	3.835	69.322			
8	.759	3.613	72.935			
9	.679	3.233	76.168			
10	.660	3.143	79.311			
11	.580	2.761	82.073			
12	.518	2.465	84.537			
13	.496	2.363	86.900			
14	.450	2.142	89.042			
15	.430	2.050	91.092			
16	.383	1.825	92.917			
17	.368	1.755	94.672			
18	.331	1.575	96.247			
19	.305	1.452	97.699			
20	.261	1.244	98.943			
21	.222	1.057	100.000			

Extraction Method: Maximum Likelihood.



Run MATRIX procedure:

PARALLEL ANALYSIS:

Principal Components & Random Normal Data Generation

Specifications for this Run:

Ncases 187

Nvars 21

Ndatsets 1000

Percent 95

Raw Data Eigenvalues, & Mean & Percentile Random Data Eigenvalues

Root	Raw Data	Means	Prcntyle
1.000000	7.042644	1.653073	1.772427
2.000000	2.467645	1.532258	1.615687
3.000000	1.181994	1.441180	1.508371
4.000000	1.087163	1.365157	1.427062
5.000000	1.026717	1.295033	1.348434
6.000000	.946099	1.233398	1.284580
7.000000	.805439	1.175662	1.220417
8.000000	.758751	1.119488	1.165139
9.000000	.678832	1.066797	1.110357
10.000000	.660105	1.015569	1.056936
11.000000	.579863	.968176	1.008212
12.000000	.517571	.921064	.958919
13.000000	.496130	.875067	.912426
14.000000	.449878	.828768	.869954
15.000000	.430447	.783091	.821772
16.000000	.383341	.738809	.779333
17.000000	.368472	.693906	.732389
18.000000	.330754	.648334	.690457
19.000000	.304992	.602173	.645777
20.000000	.261230	.551473	.596740
21.000000	.221934	.491522	.544421

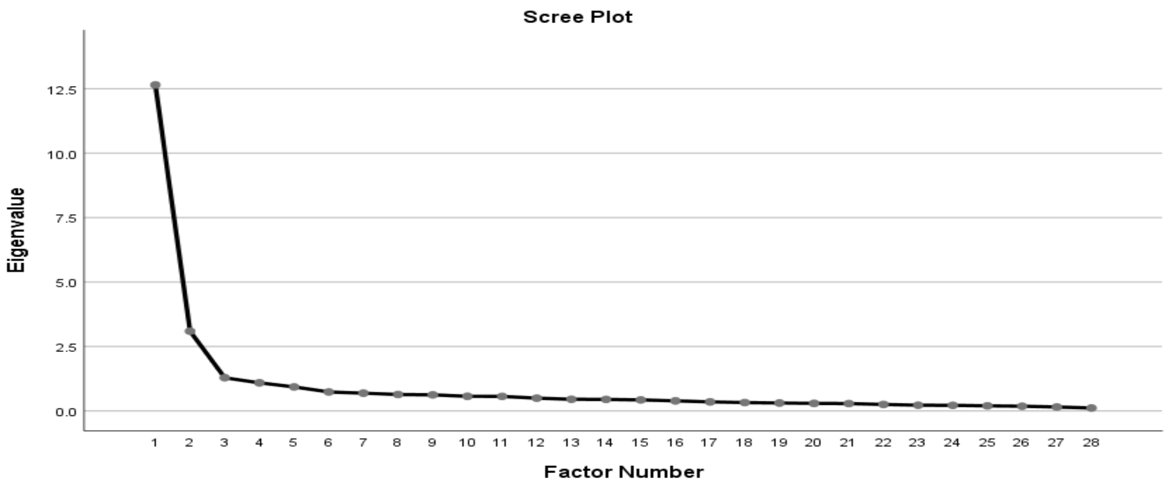
------ END MATRIX -----

Appendix 5.2c: Exploratory factor analysis for time overrun dimension

Total Variance Explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.199	32.723	32.723	2.154	9.790	9.790
2	3.288	14.945	47.668	6.633	30.150	39.940
3	2.067	9.397	57.065	2.775	12.613	52.553
4	1.106	5.028	62.093	.587	2.669	55.221
5	.880	3.998	66.091			
6	.861	3.913	70.004			
7	.828	3.764	73.768			
8	.653	2.969	76.736			
9	.626	2.847	79.583			
10	.566	2.574	82.158			
11	.507	2.306	84.463			
12	.486	2.211	86.674			
13	.438	1.992	88.666			
14	.412	1.871	90.537			
15	.383	1.741	92.278			
16	.365	1.657	93.935			
17	.303	1.376	95.311			
18	.283	1.288	96.599			
19	.281	1.279	97.877			
20	.268	1.220	99.097			
21	.192	.871	99.968			
22	.007	.032	100.000			

Extraction Method: Maximum Likelihood.



Run MATRIX procedure:

PARALLEL ANALYSIS:

Principal Components & Random Normal Data Generation

Specifications for this Run:

Ncases 187

Nvars 27

Ndatsets 1000

Percent 95

Raw Data Eigenvalues, & Mean & Percentile Random Data Eigenvalues

Root	Raw Data	Means	Prcntyle
1.000000	12.181142	1.779934	1.897839
2.000000	3.006745	1.654938	1.742712
3.000000	1.287344	1.564203	1.637457
4.000000	1.035820	1.485816	1.548634
5.000000	.932380	1.416726	1.477565
6.000000	.736109	1.352680	1.401978
7.000000	.665653	1.293100	1.341896
8.000000	.634631	1.239733	1.283756
9.000000	.623439	1.187223	1.230078
10.000000	.566787	1.138056	1.181482
11.000000	.518071	1.090091	1.130619
12.000000	.476596	1.045079	1.084047
13.000000	.453751	.999597	1.034862
14.000000	.429070	.957564	.994153
15.000000	.409338	.914480	.952503
16.000000	.391040	.874083	.910926
17.000000	.349017	.833531	.871605
18.000000	.313183	.795035	.832821
19.000000	.297486	.754891	.790023
20.000000	.287319	.716599	.753367
21.000000	.265642	.678948	.714908
22.000000	.249206	.640850	.677067
23.000000	.219138	.601961	.639111
24.000000	.209954	.562076	.599890
25.000000	.188143	.520757	.561050
26.000000	.156640	.477118	.518407
27.000000	.116357	.424931	.472414

------ END MATRIX -----

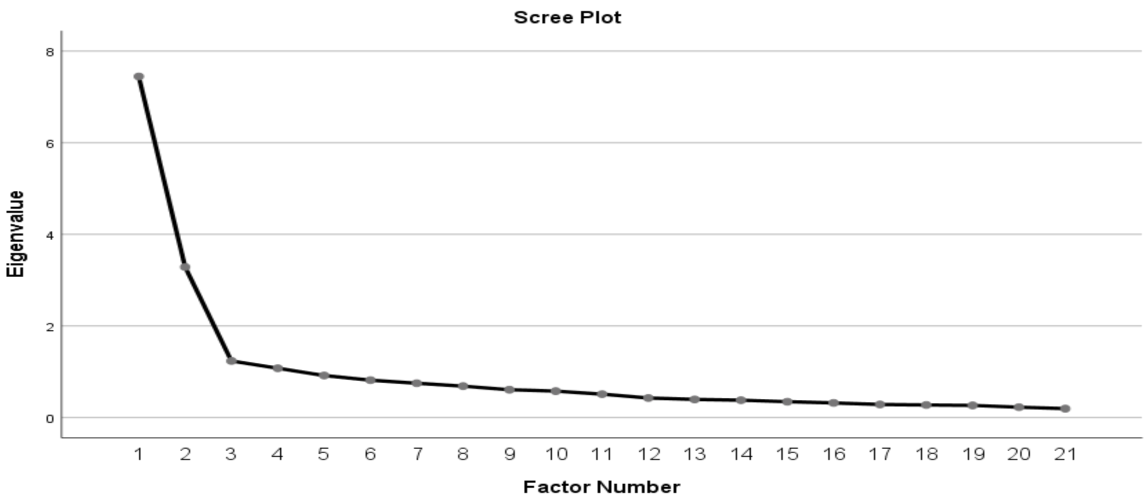
Appendix 5.2d: EFA for cost overrun dimension

Total Variance Explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	7.446	35.455	35.455	6.917	32.939	32.939	6.669
2	3.285	15.645	51.100	2.806	13.364	46.303	3.804
3	1.234	5.875	56.975				
4	1.075	5.119	62.095				
5	.917	4.367	66.462				
6	.816	3.886	70.348				
7	.749	3.566	73.914				
8	.686	3.264	77.179				
9	.607	2.890	80.068				
10	.576	2.743	82.811				
11	.510	2.430	85.241				
12	.426	2.028	87.269				
13	.394	1.876	89.145				
14	.377	1.797	90.942				
15	.345	1.642	92.583				
16	.318	1.514	94.097				
17	.284	1.352	95.449				
18	.273	1.302	96.751				
19	.263	1.254	98.005				
20	.225	1.072	99.077				
21	.194	.923	100.000				

Extraction Method: Maximum Likelihood.

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.



Run MATRIX procedure:

PARALLEL ANALYSIS:

Principal Components & Random Normal Data Generation

Specifications for this Run:

Ncases 187

Nvars 21

Ndatsets 1000

Percent 95

Raw Data Eigenvalues, & Mean & Percentile Random Data Eigenvalues

Root Raw Data Means Prcntyle

1.000000 7.445551 1.653073 1.772427

2.000000 3.285467 1.532258 1.615687

3.000000 1.233767 1.441180 1.508371

4.000000 1.075072 1.365157 1.427062

5.000000 .917158 1.295033 1.348434

6.000000 .816017 1.233398 1.284580

7.000000 .748946 1.175662 1.220417

8.000000 .685539 1.119488 1.165139

9.000000 .606824 1.066797 1.110357

10.000000 .576021 1.015569 1.056936

11.000000 .510286 .968176 1.008212

12.000000 .425806 .921064 .958919

13.000000 .394000 .875067 .912426

14.000000 .377291 .828768 .869954

15.000000 .344721 .783091 .821772

16.000000 .317947 .738809 .779333

17.000000 .283980 .693906 .732389

18.000000 .273392 .648334 .690457

19.000000 .263308 .602173 .645777

20.000000 .225157 .551473 .596740

21.000000 .193749 .491522 .544421

.

------ END MATRIX -----

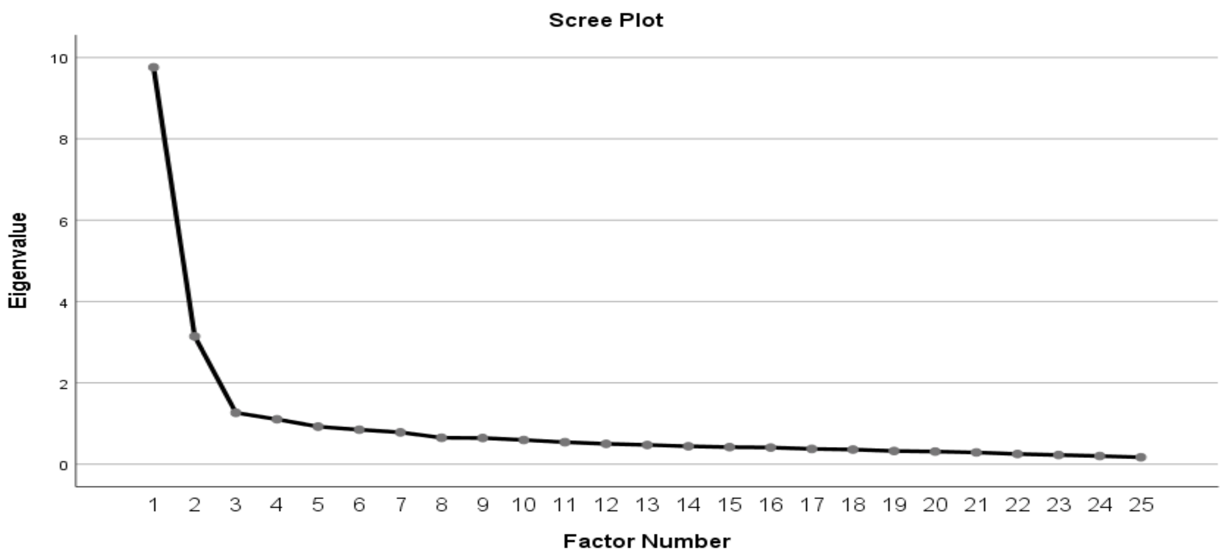
Appendix 5.2e: EFA for poor quality dimension

Total Variance Explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	9.759	39.037	39.037	9.231	36.924	36.924	8.972
2	3.143	12.570	51.607	2.650	10.601	47.525	4.666
3	1.264	5.055	56.662				
4	1.104	4.415	61.077				
5	.923	3.693	64.770				
6	.848	3.391	68.161				
7	.783	3.131	71.292				
8	.650	2.600	73.892				
9	.643	2.572	76.464				
10	.595	2.378	78.842				
11	.541	2.162	81.004				
12	.501	2.004	83.008				
13	.473	1.892	84.901				
14	.441	1.765	86.666				
15	.420	1.681	88.347				
16	.409	1.637	89.984				
17	.375	1.500	91.484				
18	.359	1.438	92.921				
19	.324	1.295	94.217				
20	.311	1.243	95.459				
21	.288	1.153	96.612				
22	.250	1.002	97.614				
23	.225	.901	98.515				
24	.200	.801	99.316				
25	.171	.684	100.000				

Extraction Method: Maximum Likelihood.

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.



Run MATRIX procedure:
PARALLEL ANALYSIS:
Principal Components & Random Normal Data Generation
Specifications for this Run:
Ncases 187
Nvars 25
Ndatsets 1000
Percent 95
Raw Data Eigenvalues, & Mean & Percentile Random Data Eigenvalues

Root	Raw Data	Means	Prcntyle
1.000000	9.759132	1.730444	1.842880
2.000000	3.142542	1.612308	1.698267
3.000000	1.263777	1.522573	1.595434
4.000000	1.103718	1.445444	1.510992
5.000000	.923236	1.377424	1.433624
6.000000	.847760	1.315890	1.370251
7.000000	.782844	1.258549	1.308026
8.000000	.649893	1.202065	1.248202
9.000000	.643087	1.149543	1.192511
10.000000	.594523	1.099890	1.140548
11.000000	.540575	1.051552	1.091258
12.000000	.500972	1.005194	1.044077
13.000000	.473079	.960892	1.001807
14.000000	.441272	.917459	.958046
15.000000	.420353	.874292	.914107
16.000000	.409288	.832648	.869785
17.000000	.374908	.791349	.828455
18.000000	.359379	.751401	.788118
19.000000	.323796	.711302	.748158
20.000000	.310685	.671999	.711351
21.000000	.288164	.631676	.669660
22.000000	.250402	.590031	.629019
23.000000	.225291	.547761	.589468
24.000000	.200320	.501824	.544631
25.000000	.171006	.446491	.495174

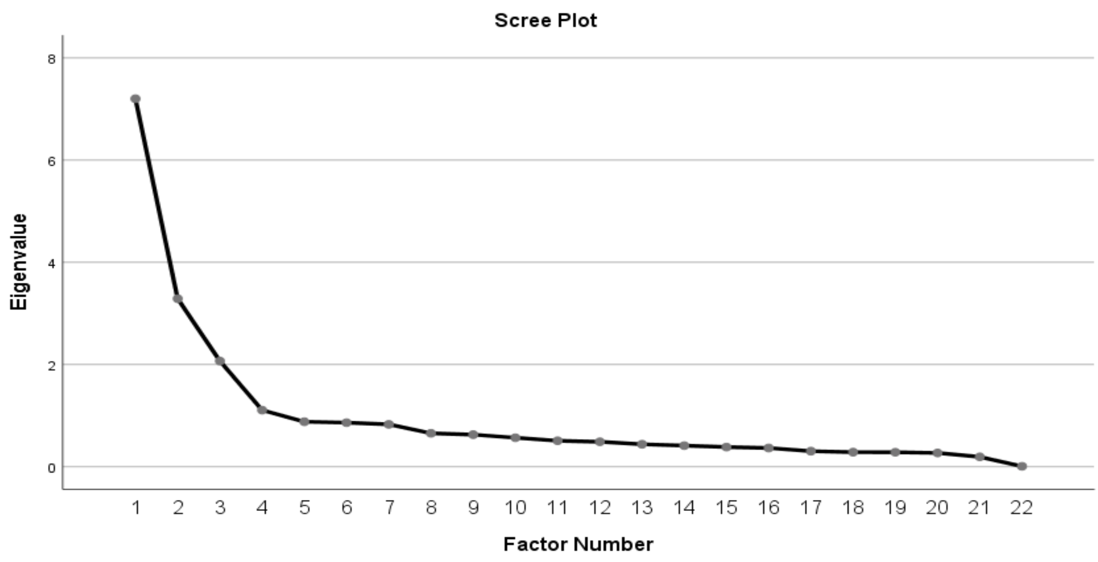
------ END MATRIX -----

Appendix 5.2f: EFA for team dissatisfaction dimension

Total Variance Explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.199	32.723	32.723	2.154	9.790	9.790
2	3.288	14.945	47.668	6.633	30.150	39.940
3	2.067	9.397	57.065	2.775	12.613	52.553
4	1.106	5.028	62.093	.587	2.669	55.221
5	.880	3.998	66.091			
6	.861	3.913	70.004			
7	.828	3.764	73.768			
8	.653	2.969	76.736			
9	.626	2.847	79.583			
10	.566	2.574	82.158			
11	.507	2.306	84.463			
12	.486	2.211	86.674			
13	.438	1.992	88.666			
14	.412	1.871	90.537			
15	.383	1.741	92.278			
16	.365	1.657	93.935			
17	.303	1.376	95.311			
18	.283	1.288	96.599			
19	.281	1.279	97.877			
20	.268	1.220	99.097			
21	.192	.871	99.968			
22	.007	.032	100.000			

Extraction Method: Maximum Likelihood.



MATRIX procedure:

PARALLEL ANALYSIS:

Principal Components & Random Normal Data Generation

Specifications for this Run:

Ncases 187

Nvars 22

Ndatsets 1000

Percent 95

Raw Data Eigenvalues, & Mean & Percentile Random Data Eigenvalues

Root	Raw Data	Means	Prcntyle
1.000000	7.199084	1.672761	1.780578
2.000000	3.287916	1.554845	1.641353
3.000000	2.067250	1.461378	1.533097
4.000000	1.106184	1.383893	1.445355
5.000000	.879568	1.316591	1.375516
6.000000	.860874	1.255604	1.306838
7.000000	.827994	1.196235	1.243740
8.000000	.653077	1.140329	1.186000
9.000000	.626345	1.088353	1.129286
10.000000	.566384	1.038670	1.080798
11.000000	.507220	.990511	1.032802
12.000000	.486409	.943288	.984713
13.000000	.438214	.897216	.937705
14.000000	.411571	.851716	.891786
15.000000	.383076	.807002	.846482
16.000000	.364502	.763655	.802102
17.000000	.302675	.719837	.762164
18.000000	.283330	.677972	.718590
19.000000	.281365	.633421	.673642
20.000000	.268357	.589225	.631620
21.000000	.191568	.537934	.584027
22.000000	.007036	.479565	.532819

------ END MATRIX -----

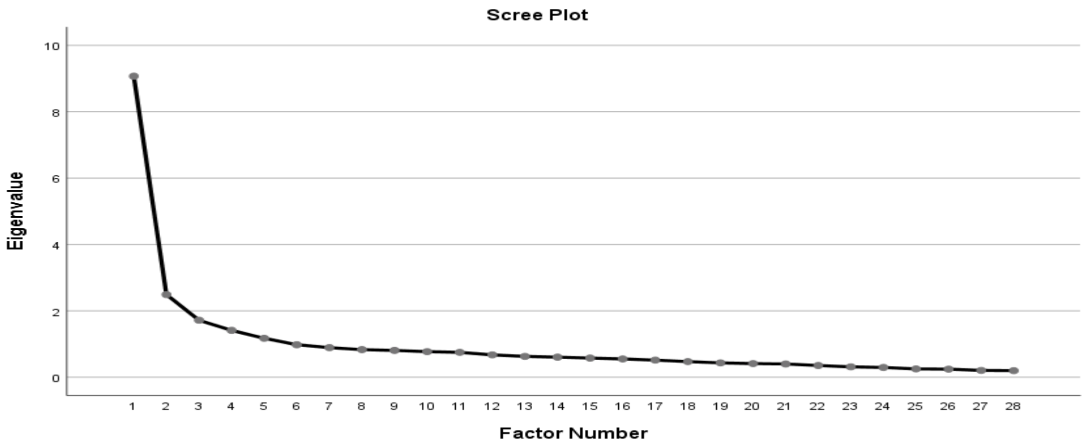
Appendix 5.2g: EFA for project stakeholder

Total Variance Explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	9.071	32.395	32.395	8.494	30.334	30.334	7.098
2	2.490	8.894	41.289	1.946	6.952	37.286	6.641
3	1.718	6.135	47.424	1.142	4.079	41.365	4.476
4	1.412	5.041	52.465				
5	1.173	4.190	56.655				
6	.979	3.496	60.150				
7	.891	3.183	63.334				
8	.831	2.968	66.302				
9	.808	2.884	69.186				
10	.770	2.749	71.935				
11	.749	2.674	74.609				
12	.673	2.405	77.014				
13	.626	2.236	79.251				
14	.604	2.158	81.408				
15	.577	2.059	83.468				
16	.549	1.962	85.430				
17	.514	1.837	87.267				
18	.470	1.679	88.946				
19	.431	1.541	90.487				
20	.411	1.468	91.955				
21	.399	1.424	93.379				
22	.353	1.262	94.641				
23	.312	1.114	95.755				
24	.293	1.047	96.802				
25	.250	.892	97.694				
26	.243	.868	98.562				
27	.205	.733	99.295				
28	.197	.705	100.000				

Extraction Method: Maximum Likelihood.

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.



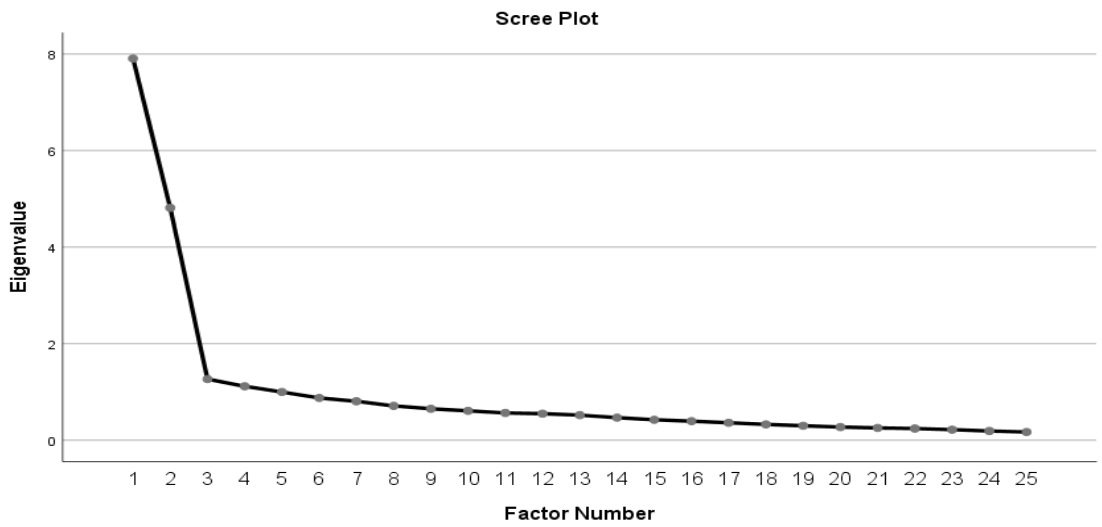
Run MATRIX procedure:
PARALLEL ANALYSIS:
Principal Components & Random Normal Data Generation
Specifications for this Run:
Ncases 187
Nvars 28
Ndatsets 1000
Percent 95
Raw Data Eigenvalues, & Mean & Percentile Random Data Eigenvalues
Root Raw Data Means Prcntyle
1.000000 9.070565 1.796554 1.917905
2.000000 2.490395 1.675917 1.767480
3.000000 1.717679 1.584503 1.655462
4.000000 1.411579 1.506112 1.570154
5.000000 1.173093 1.437496 1.493636
6.000000 .978769 1.372753 1.426650
7.000000 .891343 1.313379 1.362356
8.000000 .831098 1.260131 1.305358
9.000000 .807624 1.207982 1.253513
10.000000 .769675 1.157658 1.200745
11.000000 .748816 1.109257 1.148986
12.000000 .673308 1.062875 1.104116
13.000000 .626199 1.018736 1.056526
14.000000 .604215 .975902 1.013151
15.000000 .576598 .934917 .971639
16.000000 .549432 .892701 .928391
17.000000 .514338 .852817 .890930
18.000000 .470147 .813144 .852247
19.000000 .431374 .774916 .812968
20.000000 .411138 .737783 .775653
21.000000 .398753 .700140 .735191
22.000000 .353381 .661488 .695965
23.000000 .311920 .624741 .661304
24.000000 .293109 .587998 .622743
25.000000 .249766 .549321 .584665
26.000000 .243077 .508336 .546974
27.000000 .205256 .466645 .507722
28.000000 .197353 .415799 .462129
------ END MATRIX -----

Appendix 5.2h: EFA for project environment

Total Variance Explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	7.907	31.628	31.628	7.185	28.739	28.739
2	4.814	19.256	50.884	4.587	18.350	47.089
3	1.265	5.060	55.944	.909	3.635	50.724
4	1.116	4.466	60.409	.677	2.707	53.430
5	.998	3.991	64.400			
6	.875	3.502	67.902			
7	.806	3.223	71.126			
8	.711	2.844	73.970			
9	.650	2.601	76.571			
10	.608	2.431	79.002			
11	.564	2.256	81.258			
12	.549	2.197	83.455			
13	.519	2.076	85.531			
14	.467	1.867	87.399			
15	.423	1.693	89.092			
16	.394	1.576	90.668			
17	.360	1.440	92.108			
18	.328	1.310	93.418			
19	.299	1.195	94.614			
20	.273	1.090	95.704			
21	.254	1.018	96.722			
22	.242	.966	97.688			
23	.218	.873	98.561			
24	.191	.763	99.325			
25	.169	.675	100.000			

Extraction Method: Maximum Likelihood.



Run MATRIX procedure:
PARALLEL ANALYSIS:
Principal Components & Random Normal Data Generation
Specifications for this Run:
Ncases 187
Nvars 25
Ndatsets 1000
Percent 95
Raw Data Eigenvalues, & Mean & Percentile Random Data Eigenvalues
Root Raw Data Means Prcntyle
1.000000 7.906993 1.730444 1.842880
2.000000 4.813971 1.612308 1.698267
3.000000 1.264977 1.522573 1.595434
4.000000 1.116398 1.445444 1.510992
5.000000 .997782 1.377424 1.433624
6.000000 .875398 1.315890 1.370251
7.000000 .805861 1.258549 1.308026
8.000000 .711025 1.202065 1.248202
9.000000 .650300 1.149543 1.192511
10.000000 .607756 1.099890 1.140548
11.000000 .564025 1.051552 1.091258
12.000000 .549283 1.005194 1.044077
13.000000 .519045 .960892 1.001807
14.000000 .466838 .917459 .958046
15.000000 .423358 .874292 .914107
16.000000 .394114 .832648 .869785
17.000000 .359908 .791349 .828455
18.000000 .327586 .751401 .788118
19.000000 .298861 .711302 .748158
20.000000 .272597 .671999 .711351
21.000000 .254433 .631676 .669660
22.000000 .241578 .590031 .629019
23.000000 .218256 .547761 .589468
24.000000 .190867 .501824 .544631
25.000000 .168790 .446491 .495174
------ END MATRIX -----

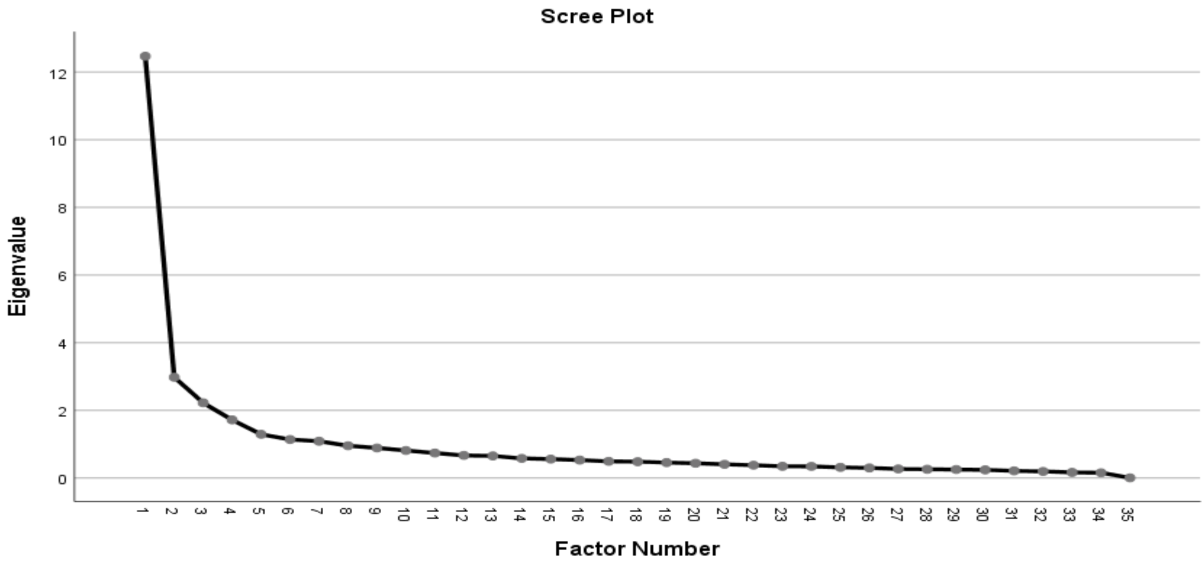
Appendix 5.2i: EFA for project life cycle

Total Variance Explained

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings[a]
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	12.466	35.618	35.618	2.272	6.492	6.492	10.502
2	2.977	8.507	44.124	11.713	33.465	39.957	9.459
3	2.222	6.349	50.473	2.208	6.309	46.266	6.194
4	1.717	4.906	55.380	1.579	4.512	50.777	2.311
5	1.291	3.689	59.069	.953	2.722	53.499	1.077
6	1.138	3.252	62.321				
7	1.088	3.108	65.429				
8	.955	2.728	68.157				
9	.889	2.540	70.697				
10	.814	2.325	73.021				
11	.738	2.109	75.131				
12	.668	1.908	77.039				
13	.654	1.869	78.908				
14	.580	1.657	80.565				
15	.559	1.598	82.163				
16	.530	1.515	83.678				
17	.494	1.411	85.090				
18	.483	1.379	86.469				
19	.457	1.304	87.773				
20	.438	1.250	89.024				
21	.404	1.155	90.178				
22	.379	1.082	91.261				
23	.347	.990	92.251				
24	.343	.981	93.232				
25	.315	.899	94.132				
26	.299	.853	94.985				
27	.268	.766	95.750				
28	.258	.738	96.488				
29	.253	.722	97.210				
30	.241	.689	97.898				
31	.213	.608	98.507				
32	.195	.558	99.064				
33	.166	.475	99.539				
34	.156	.445	99.983				
35	.006	.017	100.000				

Extraction Method: Maximum Likelihood.

a. When factors are correlated, sums of squared loadings cannot be added to obtain a total variance.



Run MATRIX procedure:

PARALLEL ANALYSIS:

Principal Components & Random Normal Data Generation

Specifications for this Run:

Ncases 187

Nvars 37

Ndatsets 1000

Percent 95

Raw Data Eigenvalues, & Mean & Percentile Random Data Eigenvalues

Root	Raw Data	Means	Prcntyle
1.000000	12.540889	1.958815	2.087286
2.000000	3.394861	1.834957	1.923044
3.000000	2.299276	1.743590	1.819751
4.000000	1.725072	1.663985	1.727667
5.000000	1.632795	1.594588	1.651047
6.000000	1.282076	1.531608	1.585622
7.000000	1.132789	1.471979	1.520971
8.000000	1.030100	1.416233	1.465609
9.000000	.924760	1.363927	1.410398
10.000000	.857264	1.314511	1.359436
11.000000	.813612	1.266873	1.310397
12.000000	.737626	1.221281	1.262119
13.000000	.667334	1.177448	1.216652
14.000000	.653926	1.133990	1.174374
15.000000	.578618	1.092021	1.127602
16.000000	.557990	1.052661	1.089790
17.000000	.529729	1.014304	1.049445
18.000000	.493843	.976494	1.010595
19.000000	.478247	.939265	.974506
20.000000	.455038	.902200	.933968
21.000000	.414222	.867650	.901701
22.000000	.397637	.832122	.863889
23.000000	.373670	.799000	.832439

24.000000	.345024	.765402	.797889
25.000000	.319728	.733104	.764094
26.000000	.313364	.700810	.733142
27.000000	.296674	.669658	.701293
28.000000	.268047	.638035	.670198
29.000000	.257264	.606909	.638574
30.000000	.252554	.576011	.605837
31.000000	.241006	.545276	.576528
32.000000	.210676	.514472	.546148
33.000000	.195207	.483980	.515153
34.000000	.165028	.452661	.483146
35.000000	.150656	.419533	.452293
36.000000	.007990	.383403	.416970
37.000000	.005408	.341241	.380929

------ END MATRIX -----

APPENDIX 5.3:
CFA-THE REGRESSION WEIGHTS

Appendix 5.3a: Regression Weights: (Group number 1 - Default model)-SCS

			Estimate	S.E.	C.R.	P	Label
SCF1	<---	SC	.262	.049	5.369	***	aaa
SCF2	<---	SC	.262	.049	5.369	***	aaa
SC14_1	<---	SCF1	1.175	.170	6.915	***	par_2
SC13_1	<---	SCF1	1.471	.199	7.385	***	par_3
SC06_1	<---	SCF1	.974	.145	6.716	***	par_4
SC12_1	<---	SCF2	2.146	.671	3.196	.001	par_5
SC01_1	<---	SCF2	1.000				
SC21_1	<---	SCF1	1.000				

Appendix 5.3b: Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
MC01	<---	SC	1.000				
MC02	<---	SC	.681	.098	6.918	***	par_1
MC03	<---	SC	1.004	.113	8.864	***	par_2
MC04	<---	SC	.725	.102	7.088	***	par_3
MC05	<---	SC	.507	.122	4.162	***	par_4

Appendix 5.3c: Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
VL01_1	<---	VL	1				
VL02_1	<---	VL	1.312	0.125	10.534	***	par_1
VL03_1	<---	VL	1.009	0.11	9.214	***	par_2
VL04_1	<---	VL	1.134	0.125	9.063	***	par_3

Appendix 5.3d: Regression Weights: (Group number 1 - Default model)-UP

			Estimate	**S.E.**	**C.R.**	**P**	**Label**
IVLF1	<---	IVLi	1				
IVLF2	<---	IVLi	1				
IVL03_	<---	IVLF2	0.812	0.144	5.627	***	par_1
IVL19_	<---	IVLF1	1				
IVL07	<---	IVLF2	1				
IVL20_	<---	IVLF1	0.936	0.127	7.345	***	par_2
IVL15_	<---	IVLF1	1.015	0.141	7.211	***	par_3

IVL09	<---	IVLF2	1.020	0.180	5.668	***	par_4
IVL14	<---	IVLF1	0.992	0.132	7.487	***	par_5

Appendix 5.3e: Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
TO7_1	<---	F1	1				
TO6_1	<---	F1	0.997	0.077	12.905	***	par_1
TO4_1	<---	F1	0.956	0.077	12.366	***	par_2
TO18_1	<---	F1	0.928	0.075	12.384	***	par_3
TO17_1	<---	F2	0.806	0.15	5.384	***	par_4
TO10_1	<---	F2	1				
TO24_1	<---	F1	0.782	0.067	11.592	***	par_6
TO16_1	<---	F1	0.8	0.079	10.163	***	par_7
TO23_1	<---	F1	0.872	0.079	11.073	***	par_8

Appendix 5.3f: Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
CO21_1	<---	F1	1				
CO20_1	<---	F1	1.009	0.09	11.165	***	par_1
CO5_1	<---	F1	0.782	0.083	9.464	***	par_2
CO19_1	<---	F1	0.96	0.091	10.594	***	par_3
CO18_1	<---	F1	0.871	0.09	9.664	***	par_4
CO8_1	<---	F2	1				
CO9_1	<---	F2	0.932	0.116	8.016	***	par_5
CO10_1	<---	F2	0.637	0.087	7.292	***	par_6

Appendix 5.3g: Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
PQ06_1	<---	F1	1				
PQ13_1	<---	F2	1.137	0.166	6.836	***	par_1
PQ16_1	<---	F2	1.159	0.174	6.655	***	par_2
PQ05_1	<---	F2	1				
PQ18_1	<---	F2	1.48	0.255	5.795	***	par_3
PQ02_1	<---	F1	0.822	0.092	8.892	***	par_5
PQ08_1	<---	F1	0.936	0.101	9.311	***	par_7

Appendix 5.3h: Regression Weights: (Group number 1 - Default model)-UP

			Estimate	S.E.	C.R.	P	Label
UP13_1	<---	F1	1.000				
UP16_1	<---	F1	.993	.062	16.011	***	par_1
UP15_1	<---	F1	.850	.059	14.452	***	par_2
UP08_1	<---	F1	.831	.060	13.948	***	par_3
UP10_1	<---	F1	.795	.054	14.671	***	par_4
UP14_1	<---	F1	.914	.063	14.601	***	par_5
UP06_1	<---	F1	.493	.058	8.552	***	par_6
UP07_1	<---	F2	1.000				
UP11_1	<---	F2	1.265	.201	6.290	***	par_7
UP01_1	<---	F2	.813	.151	5.396	***	par_8
UP02_1	<---	F2	.714	.139	5.127	***	par_9
UP04_1	<---	F2	.893	.152	5.870	***	par_10

Appendix 5.3i: Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
TD21_1	<---	F1	1				
TD05_1	<---	F1	1.023	0.094	10.863	***	par_1
TD06_1	<---	F1	0.782	0.085	9.256	***	par_2
TD03_1	<---	F1	0.85	0.084	10.068	***	par_3
TD13_1	<---	F1	0.85	0.086	9.881	***	par_4
TD16_1	<---	F2	1				
TD19_1	<---	F2	0.821	0.102	8.048	***	par_5
TD01_1	<---	F2	0.715	0.099	7.239	***	par_6
TD10_1	<---	F2	0.934	0.104	8.965	***	par_7

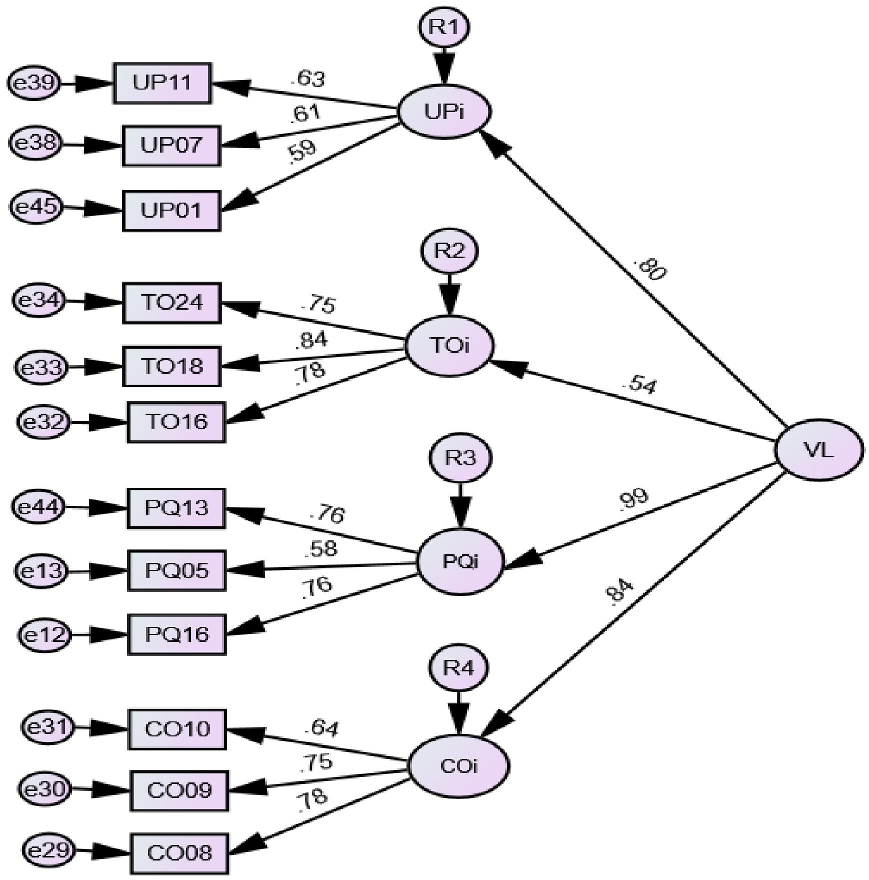
Appendix 5.3j: Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
PQ16_1	<---	PQi	1.101	0.134	8.228	***	par_1
PQ05_1	<---	PQi	1				
CO8_1	<---	COi	1				
CO9_1	<---	COi	1.001	0.108	9.255	***	par_2
CO10_1	<---	COi	0.714	0.098	7.282	***	par_3
TO16_1	<---	TOi	1				
TO18_1	<---	TOi	1.162	0.122	9.545	***	par_4
TO24_1	<---	TOi	0.878	0.098	8.95	***	par_5
UP07_1	<---	UPi	1.117	0.188	5.955	***	par_6

UP11_1	<---	UPi	1.293	0.212	6.104	***	par_7
PQ13_1	<---	PQi	1.201	0.148	8.125	***	par_8
UP01_1	<---	UPi	1				

Appendix 5.3k: Regression Weights: (Group number 1 - Default model)

			Estimate	S.E.	C.R.	P	Label
PS22_1	<---	PSF1	1.000				
PS17_1	<---	PSF1	.703	.101	6.955	***	par_1
PS24_1	<---	PSF1	.993	.108	9.220	***	par_2
PS19_1	<---	PSF2	1.000				
PS25_1	<---	PSF2	1.122	.166	6.752	***	par_3
PS27_1	<---	PSF2	1.170	.156	7.500	***	par_4
PS15_1	<---	PSF2	1.280	.185	6.911	***	par_5
PS23_1	<---	PSF2	1.323	.165	8.022	***	par_6
PS26_1	<---	PSF3	1.000				
PS28_1	<---	PSF3	.782	.133	5.870	***	par_7
PS04_1	<---	PSF3	.858	.144	5.944	***	par_8

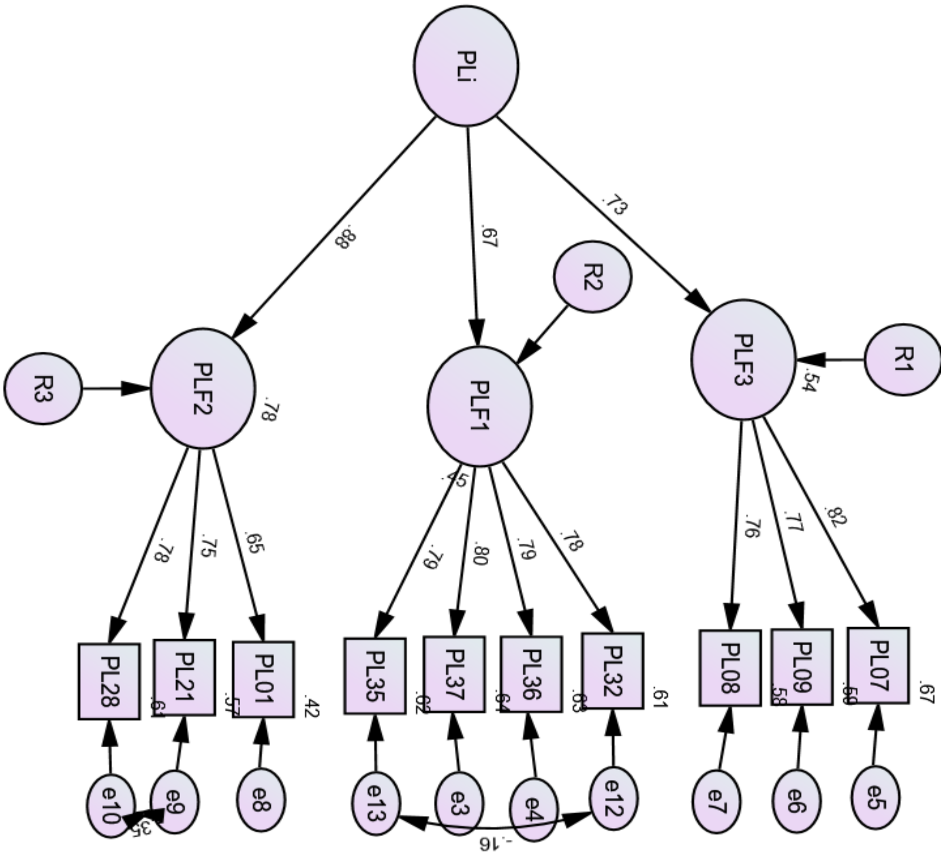


Appendix 5.3j1: Second-Order measurement model—Integrated factors for value

Appendix 5.3l: Regression Weights: (Group number 1 - Default model)-PE

			Estimate	S.E.	C.R.	P	Label
PE15_1	<---	F1	1.000				
PE17_1	<---	F1	1.023	.071	14.509	***	par_1
PE16_1	<---	F1	1.034	.070	14.867	***	par_2
PE08_1	<---	F1	.655	.070	9.345	***	par_3
PE21_1	<---	F1	.945	.077	12.294	***	par_4
PE12_1	<---	F2	.913	.107	8.555	***	par_5
PE05_1	<---	F2	.817	.093	8.826	***	par_6
PE24_1	<---	F2	.932	.098	9.500	***	par_7
PE09_1	<---	F2	1.040	.111	9.344	***	par_8
PE11_1	<---	F2	1.000				
PE18_1	<---	F2	.737	.092	8.046	***	par_9

Appendix 5.3m: Regression Weights: (Group number 1 - Default model



			Estimate	S.E.	C.R.	P	Label
PL36_1	<---	F1	.913	.080	11.477	***	par_1
PL37_1	<---	F1	1.000				
PL07_1	<---	F3	1.000				
PL09_1	<---	F3	.879	.086	10.256	***	par_2
PL08_1	<---	F3	.943	.092	10.242	***	par_3
PL01_1	<---	F2	.928	.142	6.558	***	par_4
PL21_1	<---	F2	1.000				
PL28_1	<---	F2	.985	.127	7.779	***	par_5
PL32_1	<---	F1	.898	.085	10.604	***	par_6
PL35_1	<---	F1	.829	.077	10.711	***	par_10

APPENDIX 6:
DECLARATION OF PROFESSIONAL EDIT

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Independent Skills Development Facilitator

Dear Mr Asiedu

This letter is to record that I have completed a language edit of your PhD thesis entitled, "An inclusion of value leaks into earned value analysis as a measure of project performance".

The edit that I carried out included the following:

-Spelling
-Grammar
-Vocabulary
-Punctuation
-Pronoun matches
-Word usage
-Sentence structure
-Correct acronyms (matching your supplied list)
-Captions and labels for figures and tables
-Spot checking of 10 references

The edit that I carried out excluded the following:

-Content
-Correctness or truth of information (unless obvious)
-Correctness/spelling of specific technical terms and words (unless obvious)
-Correctness/spelling of unfamiliar names and proper nouns (unless obvious)
-Correctness of specific formulae or symbols, or illustrations.

Yours sincerely

Retha Burger

1 November 2020