KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY,
KUMASI GHANA

The Influence of Key Performance Indicators (Kpis) On Project Success: Case Study of
Selected Infrastructure Projects in Sekondi-Takoradi Metropolitan Area

by

Charles Animi

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Abstract

The Construction industry is very complex in nature; and is being challenged by high-cost pressure, and increasing competition. This research aimed to investigate the influence of key performance indicators (KPIs) on infrastructure project success. Thiswas achieved through three (3) main objectives which were 1) To identify the most significant key performance indicators (KPIs) about infrastructure projects delivery in Ghana 2.) To determine the most significant factors/indicators for measuring project success of infrastructure projects delivery in Ghana 3.) To examine the intricate/underlying relationships between the most significant key performance indicators and project success. Extensive literature review was done,and a quantitative survey was designed and used in the research. Among the fifty-two (52) copies of questionnaires that were distributed, only fifty (50) copies were gotten back and this depicts 96.2%. of the responsive respondents. With the help of the techniques in quantitative data analysis (mean scores, percentages and frequencies, etc.), through Statistical Package for Social Sciences (SPSS)IBM version 23, helpful meanings were extracted from the collected data to draw meaningful results, It was deduced based on the analysis that, quality, time and cost are the three most relevant and fundamental performance indicators in infrastructure projects and functionality, safety and satisfaction of the client/customer followed subsequently. Also, the most significant Key Performance Indicator was financial KPI. Based on the findings, it was recommended that, KPIs much be benchmarked for project portfolios. Also, there must be KPI reviews of the processes regarding deviations.

Keywords: Performance, Functionality, Indicators

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Dedication

This study is dedicated to my lovely wife Dorcas Animi and children Lois Afiadom

Animi and Truelove Yaa Animi.

CHAPTER ONE

GENERAL INTRODUCTION

1.0 Introduction

Key Performance Indicators (KPIs) constitutes one of the factors that are used to measure infrastructure project success criteria. Construction project performance measurement are carried out by first defining the KPIs that will be used to judge its success. In order to achieve success in construction project, project completion should be within time, detailed budget and quality ('golden/ iron triangle'). However, this is not always the case considering the truth in many Ghanaian Infrastructure projects. Therefore, much attention need to be given to the construction industry regarding critical success factors, besides the golden/iron triangle which will results in the realization of the project deliverables.

This chapter highlights the research regarding the background of the study as well as the problem statement. The study aim and objectives have also been outlined, followed by the research questions, justification of the study, methodology to be adopted, and finally, the organization of the research report have been delineated.

1.1 Background to the Study

Humaidi and Said 2011 Stated that Infrastructure Projects have become a central activity in most developed and developing countries, and governments channeling their capital-intensive their resources in projects such as new product development, process improvement, or building new services. Presently, the following infrastructure projects (New Beposo Tollbooth, Apremedo-Kwansaworodo By-pass road, 192 MW Amandi Power project at Aboadze, etc.) are on-going in the Sekondi-Takoradi Metropolitan area. These projects are very capital intensive, and as such, some criteria

have to be set to measure their success or otherwise. Most aim of a project like the time and budget objectives, anticipation of the company, satisfaction of the client are not met and this has been proven by several studies. Defiency in technical skills, resources, knowledge of project, and top managements' are examples of factors that contribute to projects' failure as attested bySauser and Eigbe (2009), Humaidi and Said (2011). Planning and project mission weakness, poor communication,controll issues and influence due to politics all account to project failureaccording to Sauser and Eigbe (2009), Humaidi and Said (2011). Therefore,instituting KPIs will have a huge relevance in the delivery of project.

Time, cost, business performance, client changes, client satisfaction, health and safety are examples of dimensions related to perfomance indicatored and these can be measured and valued by the usage of KPIs according toCheung et al. (2004); Enshassi et al., (2009. In the construction indusrtry,the 'iron triangle', which are cost, quality and time are the major dimensions considered in the evaluation of performance.Controversally,a successful project is assumed to be one that is within the set budget, finished on time and satisfying in terms of quality and this is also known as 'golden/ iron triangle,' as affirmed by Garbharran et al., (2013). It has been evidently proven that, there is little or no truth in it. In this vein, critical factors that contribute to the success of a project need to be focused on besides the 'golden/iron triangle in the contruction industry according toGarbharran et al.,(2013). According to Ogunsanmi (2013), key performance indicators and key success indicators mean the same and assessing the success of a project is beyond making certain that the project is completed.

According to Elattar, (2009); Garbharran et al., (2013), the extent to which objectives and anticipation of a client are being met,conventionally, is termed as success of a project. The subject of success is broad and should be looked at,at different viewpoints and related goals such as education, financial, social,technical and professional issues. in different perspective. Due to the inability to perceive the success of a project, it's measurement becomes a complex task to embark on. This phenomenom cuts across in the construction industry where diverse members like the contractor, the other stakelohders,different surveyors' engineers,the architect and the client are involved.Thirteen critical factor in relation to success of a projectfrom malaysian contractor's perspective were established by Al-Tmeemy et al. (2010) and Garbharran et al., (2013).The critical factors identified were satisfaction of the customer, quality, cost, time, competitive advantage, technical specifications, achieving scope, safety, functional requirements, market share, reputation, revenue and profits, and benefit to the stakeholder.

The first publication of KPIs in the construction industry was in 1999, and annually updated by the working group in UK. The Headline KPIs are derived from the 5-4-7 model first put forward in the UK's Egan Report (1998) "Rethinking Construction." The fundamentals for the national Headline KPIs in UK are these improved targets., which were intended to depict how upgrading would be revealed. According to Swan and Kyng, (2004), the usage of these KPIs to assess the drive improvement and performance have gained popularity. The process by which the effectiveness and efficiency of an action is being quantified is known as performance measurement. According toNeely, (2005) Basheka and Tumutegyereize, (2011),how useful a performance management system is,is dependent on the enablement of the system to

acts a mechanism that will aid in assessment, provision of beneficial information and identification of problems, permitting resultin contradiction of definite scheduled standards to be achieved. One of the factors in the criteria of project success is KPIs. One of the critical measures for a success in a project and in an organization is the inculcation of KPIs as attested by Swan and Kyng (2004). KPIs are interpreted as a means which help in the effective measurement of position or performance and improvement of company's business as attested by Price Waterhouse Coopers (PWC) (2007) publication. It was affirmed by Thoor and Ogunlana (2010), together with Humaidi and Said (2011) that, another helpful means in the comparison of real and budgeted performance regarding proficiency, usefulness and quality of artistryand product is by the usage of KPIs. The performance operation of most construction projects is being measured by the usage of KPIs. Additionally, a criteria of objective can be offered byforming KPIs in the measurement of performance.

The process by which the progress of an organization is reviewed against the organization's goals by the usage of quantitative and qualitative measures is the formal defintion given to Key Performance Indicators (KPIs)according to Public Record Office Victoria (2010). The departments and individuals are poised to do their best to achieve these set targets that are broken down and the accomplishment of these targets are regularly reviewed. Ten parameters in relation to the achievement of pleasing performance of project in response to Egan's report (1998)have been brought into light by UK working group on KPIs according to Takim and Akintoye (2002).Client satisfaction (product),construction time,defects, predictability cost,construction cost,client satisfaction (service), productivity,predictability time, profitability, safety are the ten parameters and also defined in the "Rethinking Construction" in the 5-6-10 model as headline of KPIs. In the Ghanaian construction

industry, innovative solution is deemed as the enabler for performance execellence in project delivery according to Moullin (2004).

1.2 Statement of the Problem

The importance of specifying the factors which affect the performance needed to improve the performance of the infrastructure projects has now been recognized in several countries at various levels. Underlying relationships among the factors that contribute to project success can provideessential insights for success (Cserhátiand Szabó, 2014). Also, Identification of success factors can help in the selection of project team members, identification of their development needs, and forecast of the performance level of a project before it commences and support the firms to decide their strategic standing on the project (Toor and Ogunlana, 2008). Despite the significant role of infrastructure projects to the economy of Ghana, most clients and other stakeholders of projects are particular about the Ghanaian contractors' performance. According to Ahadzie (2007), blames are always apportioned to contractors when there is a bad performance and In many instances, contractors are blamed in case of poor performance and criticized for no knowledge on relevant techniques on management application. Ghanaian contractors are generally perceived to be poor in terms of performance in the Ghanaian society. Most problems that had an effect on the Ghanaian construction firms were looked into by Moulin (2004).Some of the problems noticed to have an effect on the construction firms were insufficient working capital, poor management, poor engineering capacity and bad workmanship.

According to Beatham et al., (2008), assessment of performance is very important to any effort to develop performance.Alarcónet al., (2001) added that, to achieve a

highly recognized and acceptable performance, performance measurement should not be overlooked. According to government of Ghana and some key group of contractors, the cause of bad delivery of projects is as result of insufficient or no measuring tools for performance for Ghanaian contractors. In the attempt of the government of Ghana tosolve this problem recommended that,only competent contractors are awarded with projects and this means is deemed as a performance measurement tool (Yeboah, 2007).The effectiveness of the quest to improving the performance measuring system for Ghanaian contractors is highly dependent on the choice and usage of essential indicators and measures of performance as a standard for measuring performance and this will consequentially develop Ghanaian contractors' performance as well procurement effectiveness according to Bond (1999). Ofori-Kuragu (2014) affirmed that, most Ghanaian contractors are not or slightly aware of performance measures and indicators and this is due to the fact that, the indicators for the measurement of performance are not common. Ghanaian contractors have to take advantage of some relevant performance indicators that are in existence. The sheer numbers available create "paralysis by analysis" (Robson, 2004) where inability to adapt the right performance measures amount to inaction. A performance can be deteriorated quickly by the selection of too many or wrong performance measures.Robson(2004) attested that, finding minimum set of criteria which can detect the acceptance or rejection of overall performance is the practical way of choosing performance measures.

Some literatures expand on some general principles on how KPI can be realized, example is the COBIT framework (Brad and Scott, 2007). The limitation of this framework was that, it was of essence to specific type of IT companies, and was not applicable in the industry. Another framework that was of essence for organization in

achieving great level of strategy in their business performance but had its limitation was the concept of balanced scorecard concept established by Kaplan and Norton (1996). The limitation for this framework was that, it was focused on a thorough operation level and could not be used largely due to this.Performance prism was also introduced but lack the strength to look at KPIs holistically. A lot of various measures are necessary for different market situation, competitive environment and product strategies. According to Kaplan and Norton, (1993) performance measurement that suit a business unit should be designed to suit the strategy, culture, mission and technology of the business unit. There is a deficiency of insight in improving the appropriate and efficiency of KPIs in a lot of organizations and this resulted in the misusage and misbranded of KPIs. Parameter (2007) attested that, there is absence of focus, alignment deficiency and achievement way below what is expected when a company with 20 KPIs is being examined.

Several infrastructure projects do not see the light of the day or are abandoned in the process of near completion in the Sekondi-Takoradi metropolis. Typical examples are Fijai-Effia Nkwanta road, New Beposo Tollbooth, New Takoradi- Ghacem road, etc. These happen because there are no KPIs to measure performance during the initial project phase. Again, even if there are KPIs, they are woefully inadequate or not detailed enough to measure as a success criterion of infrastructure projects in the metropolis. A standard or stand-alone KPIs for the success of infrastructure projects does not exist in the Ghanaian context. The identified gaps in the reviewed literature is what the present study seeks to address. The essence of this research is to pay more attention to the KPIs and their relation to infrastructure project success in the Sekondi-Takoradi metropolis.

1.3 Aim and Objectives

1.3.1 Aim

The study aims to investigate the relationship between key performance indicators and project success of infrastructure projects in Ghana.

1.3.2 Objectives

The following specific objectives of the study;

1. To identify the most significant key performance indicators (KPIs) in infrastructure projects delivery in Ghana.

2. To determine the most significant factors/indicators for measuring project success of infrastructure projects delivery in Ghana.

3. To identify the intricate/underlying relationships between the most significant key performance indicators and project success.

1.4 Research Questions

The following research questions will guide the study:

1. What are the key performance indicators (KPIs) about infrastructure projects delivery in Ghana?

2. How can we determine the most significant indicators for measuring project success in Ghana?

3. What is the relationship between the most significant key performance indicators and project success?

1.5 Scope of the Study

Geographically, the study was limited to infrastructure projects in the Sekondi-Takoradi Metropolis. This is because of the recent oil find in the area, a lot of infrastructure projects have sprung up. It is hopedthat construction project managers

and consultancy firms within the catchment area will help in getting a realistic assessment for the study (Kukah, 2016). The study was limited contextually to infrastructure construction projects management. This is because most infrastructure government projects are now taken shape in the area and therefore getting information will not have a lot of challenges. The respondents was construction professionals like quantity surveyors, project managers, contractors and procurement officers involved in infrastructure projects and other stakeholders.

1.6 Methodology

The study depended on the positivist approach, suitable ontology, epistemology, and axiology to direct the data collection, analysis and the interpretation of the findings that will help deal with the aim and objectives. Quantitative research strategy was adopted for the study. This is confirmed by Cresswell, (2003), who suggested that a quantitative approach involves choosing a post-positivist claim in an investigation that helps develop knowledge and explore relationships among variables regarding hypothesis, accuracy, reliability, and removal of bias.

Since the study is dealing with infrastructure construction projects, the researcher anticipates challenges in determining the actual population as a result of lack of a comprehensive database of the current classification of Ghanaian contractors (GSTDP, 2010). Furthermore, the population size might be small, coupled with the need for respondents who are willing to give information; purposive sampling method will, therefore, be adopted. Purposive sampling method which is a non-probabilistic sampling method will be utilized,and the choice is to help the researcher choose respondents who are willing to give information by merit and provide answers in the field of study (Tongco, 2007). The target group was professionals working in

government agencies, consultancy firms and construction companies involved in infrastructure construction projects in the Sekondi-Takoradi Metropolis.

Structured survey questionnaires were used in collecting data for the quantitative research. The design of the formal survey questionnaires was dependent on the variables obtained from the literature and the objectives of the study. Questionnaires that were administered to respondents will be in the form of close-ended questions. Questionnaireswere in two parts, the first part comprising of demographic information and the second part of assessing each specific objective. Furthermore, the descriptive test statistics and mean score ranking was used for the analysis. The analysis was done with the aid of the Statistical Package for Social Sciences version twenty-three (SPSS v 23).

1.7 Significance of the Study

Infrastructure projects are critical to any developing country and its citizenry. However, the case is not always as expected. A lot of professionals in the construction industry have been engaged in the influence of KPIs on projects which is deemed to be critical. This research seeks to assist construction firms on how to mitigate or carefully handle risk on projects. This assistance will be beneficial to professionals in the construction industry on how to effectively plan and complete projects by the usage of the right KPIs for the success of the project. The Ghanaian construction firms will also benefit from this research as it will provide them with some helpful recommendations on the right management practices on projects.

This research will also provide clients, consultants, sub-contractors, etc. in the construction industry with relevant knowledge on KPIs in the successful management

of projects. Individual in academia like lecturers and students of different tertiary institutions will gain much from this research as this research will add up to the already existing knowledge in the field and also be used as learning and teaching tool. Again, like many developing countries, Ghana is at a very crucial part of its development as a result of the prospect of the oil revenues from its oil reserves (Ahadzie, 2009). It is estimated as the world leader in economic growth, with a rate of 20% (Economy Watch, 2011), and as such projects have become a focal point in this development.

The question as to whether these projects will be successful in sustaining this growth had become an issue for many Ghanaians and some commentators because past governments have been enthused about similar projects before but these projects ended in failure (Central Press, 2011; Daily Guide, 2012; GNA, 2012). Therefore, using Ghana as a case study will benefit the Ghanaian government by throwing more light on the extent of projects failure, why projects fail and how this failure negatively impacts on key stakeholders of such projects. This will help the government to be more proactive in awarding project contracts in the future.

This study will also contribute to theories of influence of KPIs on project success, causes of project failure and the effects of project failure on stakeholders in developing countries. This will contribute to both the academic and the practical fields. Thus, by studying government projects failure in Ghana, the study will contribute to both the local and broader academic context in project management. This will add an academic lens to the literature.

1.8 Organization of the Chapters

The study consists of five chapters and is organized as follows:

Chapter One: The topic; '**the influence (effect) of key performance indicators (KPIs) on project success: case study of selected infrastructure projects in Sekondi-Takoradi metropolitan**'' was briefly talked about in in this chapter. This is of essence because it gave a synopsis of the research which is inclusive of research study's structure. This chapter is inclusive of the background of the study, the aim of the study, the objectives of the study together with the research questions, the rationale behind the study, the relevance of the study and the limitations present in this study.

Chapter Two: In this chapter of the study, theories and models that are of relevance to the research topic were explained. These theories that are of essence to the topic were gotten from journals and papers and properly cited with the right references.

Chapter Three: Provides information on how this study was conducted. Beginning with the study methodology, population and sample size, data collection procedures, instrumentation, data analysis procedures, limitation of the research and ethical issues.

Chapter Four: Provides findings and the discussion of the results of the study.

Chapter Five: Provides a summary of the findings, conclusion, and recommendation and direction for future work.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

A review of literature or library research is of essence when conducting a research project according to Lehtinen et al. (2014). The relevance of reviewing literature has been acknowledged by a lot of researchers in their project. This is mainly due to the valuable overview a proper literature review gives about the topic of the research, area of research and the data gathered from earlier researches on the similar topic. An assessment of the entire project is the critical thing to do in efficient project delivery as attested by Heagney (2012). The problem as well as factors pertaining to a research topic can be identified by reviewing the research in the right way or standard. Therefore, managers or initiators of a project are recommended to improve and provide effective projects by setting key performance indicators with the target that the success is the final goal of an organization's projects.

Deficiency in specialization, support of administration, constant renewal of employees, insufficient technologies and bad correspondence of group are usually the factors that have an influence on project success. Hence, in the quest to make projects successful, identification of potential gaps in the project and the usage of the right management methodology of the project should be considered. The key performance indicators and their influence on the success of infrastructure projects in the Sekondi-Takoradi Metropolis is the main focus of this study.

2.2 Overview of Projects

For an aim or objective to be achieved or accomplished, a temporal work has to be set to preserve numerous limitations and this is can be defined as a project. All projects

are different and requires different operations as attested by Kerzner (2013). Every project is unique and cannot be considered as a routine operation. Resources, time and assets of a company are considered by developers of projects or managers as part of the numerous limitations when a project is being developed. The primary purpose of every project is to be beneficial to its stakeholders and the company as affirmed Burke (2013).

The definition or how different aparticular project is, is dependent on numerous factors like the consequences and benefits derived from that project although all projects have aims, project strategy selection and commencement of the project. However, the process that helps enthusiasm of workers in an organization to be connected to achieve the goals of the organization can be defined as a specific project. An unstandardized and sophisticated effort which is controlled by plan, asset and time as well as determinations of workers is described as project by Larson and Gray (2011). It can be deduced from the various meanings of project that, operations are performed by companies or small project that help in an organization's growth (Burke 2013).

2.3 The Concept of Project Management

Project management can be said to a formula, which is obtained from association that assist managers of a project to coordinate information, skills and approaches to maintain, put in order and execute a project the usage of the right requirements within the available resources and deadline given by the organization. According to Heagney (2012), the process by which the desired project goals of an organization is met by the assistance of the strength of an organization as well as the resources of the organization is described as project management. One of the relevant aspects of

project management is the consideration of the provision of all of the organizations' requirement. Again management of a project requires the usage of an organizations' techniques, tools and systems to control the management of the projects' process. The development of a project depends on the resources and the organizations' structure.

For a project to be deemed as successful, there are six outlined project management phases that the project must satisfy. These phases are the initiation stage, definition stage, design stage, development stage, implementation stage and the follow up stage as attested by Špundak, (2014). The appropriate correlation of these phases help with the completion of the project. These phases also when correlated properly offers how the project is to be directed. In most cases the expected plan and cost of the project after considering the phases during the execution of the project is exceeded by a percentage of 33 as affirmed by Kerzner (2013). This therefore becomes a compulsion by the organization's demand to alter project management procedures. It is incumbent on the project manager to take charge of the relevant changes that have to be made in the management process in relation to the capital. The application of core values in management of projects areas to a project warrants project success. It is affirmed by Young, (2013) that, management attention, the team's spirit, focus on the client and understanding communication are the parameters of the main values of project management.

2.4 Definition of Project Success

The main aim of the manager is to see to it that, success is achieved in an undergoing project which is inclusive of time, cost and what stakeholders are anticipating. Success of a project becomes evident when the actual cost of building is within the cost budgeted for as well as meeting project deadline and lastly meeting customers'

expectation as affirmed by Scott, (2013).The main success of a project as proposed in a lot of literature is meeting the objective of the project. Success is again perceived by other adept researcher to be the process whereby the aim of the project is achieved by the investing money and time to the objective. Scott (2013) attested that, the achievement of successful project is dependent on the ability of an organization to combine the organization's resources inclusive of the skills, assets and unexpected happenings of the project.

2.5Project Performance Indicators

In the US-based Development Industry Institute, an apparatus has been invented to help in the various stages of a project and this is known as the Project Definition Rating Index. In case of R and D project work, development of the Integrated Performance Index provides insight regarding the practical experience of Project Management. The DQI (Design Quality Indicator) is designed with three main outlook and assist in improving the project work outline. Additionally, in the case of R and D projects the application of IPI is associated with concern of eight stages inclusive of risk, benefit, actual decisions actual decisions and actual decisions as affirmed by Caniëls and Bakens, (2012).

Project managers are tasked to ensure that success is evident in a project. This is achieved by establishing relevant changes which considerations of multi-dimensional and multi-criteria approach as affirmed by Patwardhan et al., (2016). The ability to group the criteria is one of the relevant ways to ensure success. The possible four gathering of the requirementsis inside target of the project, advantage towards the client, unswerving commitment and future door Mir and Pinnington, (2014).

Key performance indicators are measurable indicators that demonstrate the level of achievement in a project. KPIs provide information to the decision makers to measure

performance and to compare them with the intended outputs, outcomes, goals, and objectives and were chosen to reflect the success criteria of a project (Omran and Mamat, 2011). The purpose of the KPIs is to enable measurement of the project and organizational performance. The process of developing KPIs involved the following issues (Chan and Chan, 2004).

1. KPIs will need to evolve, and it is likely that a set of KPIs will be subject to change and refinement

2. For performance measurement to be effective, measures or indicators must be accepted, understood and owned across the organization.

3. Data collection must be made as simple as possible.

4. The large sample size is required to reduce the impact of project specific variables. Therefore, KPIs should be designed to be used on every building project 5.

5. The systematic use of KPIs is essential as the value of KPIs is almost completely derived from their consistent use over some projects

6. Only a limited, manageable number of KPIs is maintainable for regular use. Having too many (and too complex) KPIs can be time- and resource-consuming.

7. KPIs are general indicators of performance that focus on critical aspects of outputs or outcomes.

8. Graphic displays of KPIs need to be simple in design, easy to update and accessible.

Crucial different performance indicators used by various researchers and each indicator describes project performance differently. The following indicators were the most common KPIs had been used in previous literature studies:

2.5.1 Time and Cost

Performance in relation to cost is as essential to the entire construction parties as performance in relation to cost (Meeampol and Ogunlana, 2006). Predictably completing a project, on time, within schedule is a critical KPI (Li *et al.*, 2012). Time is defined as the degree to which the general conditions promote the completion of a project within the allocated duration (Chan *et al.*, 2002; Lam *et al.*, 2007). It is measured by using overrun of the time, construction time, and construction speed (Chan *et al.*, 2002). Cost is defined as the degree to which the general conditions promote the completion of a project within the estimated budget (Chan *et al.*, 2002; Omran and Mamat, 2011; Lam *et al.*, 2007). It can be measured by the cost overrun and unit cost (Chan *et al.*, 2002). Specifically, regarding unit cost, the percentage of net variation over the final cost (Chan and Chan, 2004). Chou *et al.,* (2013) considered the cost refers to the budget.

Cost performance is the most important indicator of project success used by all parties (Li *et al.*, 2012). It presents the firm's profitability, productivity and is always used to measure project performance against the estimated target (Meeampol and Ogunlana, 2006; Memon *et al.*, 2013). In the quest to achieve success throughout the phases of the project, cost and time should be measured at the start of the construction through to the construction phases of the project. time and cost should be constantly kept under the watch to avoid delays(Chan *et al.*, 2002). Delays should be avoided as any delay caused brings in an increase in the construction cost. (Meeampol and Ogunlana, 2006; Ahsan and Gunawan, 2010).

2.5.2 Health and Safety

Health and safety are defined as the degree to which the general conditions promote the completion of a project without significant accidents or injuries (Chan *et al.*,

2002). It is well known that construction projects have many work-related accidents and injuries and a successful safety program can be measured in terms of no injury to people, no damage to equipment, machines and tools, no damage to environment, no loss of market competition, no damage to company image or brand-name, and increased productivities (Aksorn and Hadikusumo, 2008). The measurement of safety is mainly focused on the construction period as most accidents occur during this stage (Alzahraniand Emsley, 2013). With the increasing complexity of construction projects and the rapid increase of construction activities, construction safety has become a big concern because workers' injuries cause tremendous losses (Ali *et al.*, 2013).

2.5.3 Value and Profitability

Profitability is also considered one of the most important key performance indicators (Ali *et al.*, 2013). Profitability measures the financial success of the project. Nowadays, competition is increasing, and firms are aware that the project must be adequately managed to be profitable (Chan *et al.*, 2002).Value is the evaluation or assessment of how an owner is satisfied with his or her needs which is inclusive of quantity produced, globally. It includes the realization for the owner of quantity manufactured, costs of operation and maintenance, and flexibility. This can be measured as "business benefit" derived from the completed project (Chan and Chan, 2004). According to Chan and Chan (2004), the most common measure of financial achievement is net present value (NPV).

2.5.4 Quality

Quality is to be assessed in both preconstruction and construction phases as it forms the ''iron triangle'' with time and cost that is fundamental KPI of the project (Chan *et al.*, 2002). Final product quality and process quality that meet and exceed owner requirements are an important part of project success (Li *et al.*, 2012). Sanvido *et al.,*

(1992) defined the quality defined as the totality of features, attributes, and characteristics of a facility, product, process, component, service, or artistry that bear on its ability to satisfy a given need: fitness for purpose. Another close definition of quality used by Lam *et al.,* (2007) and Ling and Bui (2010) were that quality is the output quality of the service rendered or work is done from the technical and artistry aspects. Chou *et al.,* (2013) considered the quality as performance outcome.

2.5.5 Functionality

This is where the anticipations of the members of the project is correlated and best assessed whether the technical performance is in conformance. The financial and technical aspects implemented to technical specifications should be considered, to achieve the ''fitness for purpose'' objective (Chan *et al.*, 2002).

2.5.6 Productivity

Productivity is generallyestablished as KPI, and it is the foremost key to the cost-effectiveness of projects. It refers to the amount of resource input to complete a given task, and it is usually assessed on a ranked basis (Chan *et al.*, 2002). Shehata and El-Gohary (2012) considered that proper management of resources in construction projects could yield substantial savings in time and cost. In order to improve project performance, they suggested that variability in labor productivity should be reducedabout available workload and capacity (work hours). These variations that affect labor productivity and is defined as the time difference between what was planned and what occurred regarding task starting times and duration.

2.5.7 Benchmarks

Benchmarking is currently considered as one of the most effective approaches to help a company to improve its performance, and they regarded as the search for "best

practice" (Lam *et al.*, 2007). Benchmarking can be defined as a process of continuously measuring and comparing an organization's business process against business leaders anywhere in the world to gain information which will help the organization to take action to improve its performance (Shehata and El-Gohary, 2012). Another definition of benchmarking was "A systematic process of measuring one's performance against results from recognized leaders to determine best practices that lead to superior performance when adopted and implemented" Ali *et al.*, 2013). Construction companies can benchmark their performance to enable them to identify strengths and weaknesses and improve their performance (Lam *et al.*, 2007).

2.5.8 Satisfaction

The level at which architects, contractor, various subcontractors, clients, engineers, third parties and end-users, etc., are pleased with a project and can have effect on a project is describe as satisfaction. (Chan *et al.*, 2002; Lam *et al.*, 2007). Chan and Chan (2004) divided satisfaction to (1) user expectation and satisfaction and (2) Participants' satisfaction. User satisfaction describes the level of achievement of the expectations in a project (Li *et al.*, 2012). Success for a given project participant is defined as the degree to which project goals and expectations are met, these goals and expectations may include technical, financial, educational, social, and professional aspects (Sanvido *et al.*, 1992). Satisfaction as KPI has been found to be better than purely economic criteria that can be turned into corrective managerial decisions and actions (Lehtiranta *et al.*, 2012).

2.5.9 Environmental sustainability

According to Chan *et al.*, (2002), construction has a bad influence on the environment. The quantum of waste generated during construction has a bad impact on the environment. Lam *et al.*, (2007) affirms that, the waste generated can be

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measured by the difference between the amount of work finished and the amount of materials conveyed to the site.

2.6 KPI on Developing Countries Infrastructure Projects studies

Shenhar *et al.,* (2001) conducted a study to develop a multidimensional framework for assessing project KPIs. Shenhar *et al.*(2001) grouped KPIs into (1) project efficiency, (2) impact on the customer, (3) direct business and organizational success, and (4) preparing for the future. They suggested these dimensions should be addressed during the project's definition, planning, and execution phases. They also concerned with customer needs, competitive advantage, and future market success, and rather than sticking to the initial plan; they keep making adjustments that will create better business outcomes.

Chan *et al.,* (2002) aimed to establish criteria for project success for a design/build project in construction. They conducted a comprehensive review of the literature over ten years to make a framework for success criteria. They classified KPIs into objective measures which were safety, time, profitability,cost health and and subjective measures which were quality, productivity, satisfaction, functionality, technical performance and environmental sustainability.

A set of key performance indicators (KPIs) was developedby Chan and Chan (2004) to assess success of construction. They measured a set of key performance indicators (KPIs), both objectively and subjectively through a comprehensive literature review. Their study showed that the cost quality and time are in good general indicators of the performance of construction projects and other measures, such as safety, functionality, and satisfaction, etc., were important too. They also furnished to project

managers, clients and other project stakeholders useful information to implement a project successfully.

Cheng (2007) endeavored to predict project success dynamically. They proposed an evolutionary project success prediction model. Their model is developed based on a hybrid approach that uses genetic algorithms, fuzzy logic, and neural networks. They used KPIs which were actual design complete, actual owner expenditures, cost of contractor project commitments, and cost of owner project commitments, actual owner effort hours, and recordable incident rate by period, actual overtime work, cost of change orders, the number of change orders and days lost to weather gross working days.

Lam *et al.* (2007), aimed to develop a project success index (PSI) to benchmark the performance of design-build projects from a number KPIs. They claimed that a construction project is mostly initiated by the needs of the client. In order to satisfy the client's requirements regarding time, cost and quality, various procurement methods are used to increase the chance of success for the complex sequence of activities one of them is a design-build strategy. They formulated an equation to benchmark project success, and their findings showed that time, cost, quality, and functionality should be the principal success criteria for design and built projects.

In Ghana Ahadzie*et al.*(2008), conducted a research to address what constitutes the determinants of success in mass house building projects (MHBPs). They used a questionnaire survey, andthey classified the KPIs into four main clusters, namely environmental impact, customer's satisfaction, quality and cost, and time.Another study in Ghana held by Ofori-Kuragu*et al.,* (2016) targeted to establish a set of key performance indicators (KPIs) that will suit in the measurement of the Ghanaian

construction. They measured a set of key performance indicators (KPIs), both objectively and subjectively through acomprehensive literature review. Their study showed that Client Satisfaction, Cost, Time, Quality, Health and Safety, Business Performance, Productivity, People, and Environment are in good general indicators of the performance of construction projects success in Ghana.

Cho *et al.,* (2009) conducted a study to analyze the overall relationship between project performance and a project's characteristics. They employed factor analysis method and a structural equation model (SEM) on quantitative data from actual case studies to analyze relations. They concluded that the quantitative KPIs measured construction were cost (i.e., award rate, unit cost, cost growth, etc.) and construction time (i.e., construction speed, delivery speed, schedule growth, etc.), while the qualitative KPIs evaluated the quality (i.e., turnover quality, system quality, etc.), and the owner's satisfaction.

In Vietnam Ling and Bui (2010) examined the factors that lead to successful outcomes in construction projects. They used case studies technique, andthey used the following KPIs as a sign of successful results:

1. Project delivery which determined by the budget performance, schedule

the service rendered or work done from the technical and artistry aspects".

2. Organizational level competency which determined by owner satisfaction.

3. Profitability

A study in Malaysia by Al-Tmeemy*et al.,* (2011) aimed to propose a framework to categorize project success for building projects in Malaysia from the contractors' perspective. They divided the KPIs into three dimensions which were project management success, product success, and market success. These dimensions included thirteen KPIs which were cost, time, quality, safety, achieving scope,

customer satisfaction, technical specifications, functional requirements, market share, competitive advantage, reputation, revenue and profits, and benefit to the stakeholder.

In Saudi Arabia Ali *et al.,* (2013) conducted a study to explore the most important KPIs for measuring company performance as perceived by large building contractors working in Saudi Arabia. They used a survey on a randomly selected sample of large construction firms. They Figured out the most significant KPIs are profitability, quality of service and work, growth, financial stability, cash flow, external customer satisfaction, safety, business efficiency, market share, and effectiveness of planning.

2.7 Critical Success Factors for Infrastructure Projects

Yang *et al.,* (2009) defined "CSFs as those critical areas of managerial planning and action that must be practiced in order to achieve effectiveness". or "CSFs are inputted to project management practice which can lead directly or indirectly to project success and they encompass many elements, which have to be synchronized to ensure the project delivery on time" as described by Alias *etal.,* (2014 p61).

Comprehensive success criteria must reflect different interests and views, which lead to a multi-dimensional, multi-criteria approach (Dvir*et al.,* 2003). Successful construction project manager may or may not resonate the same way with the construction project owner, project engineer, operator, or maintenance staff (Hughes *et al.,* 2004). From a project management perspective, critical success factors (CSFs) are characteristics, conditions, or variables that can have a significant impact on the success of the project when adequately sustained, maintained, or managed (Milosevic andPatanakul, 2005). An architect may consider success regarding aesthetic appearance, an engineer regarding technical competence, an accountant regarding dollars spent under budget, a human resources manager regarding employee

satisfaction and chief executive officers rate their success in the stock market (Shenhar*et al.*, 2001).

Toor and Ogunlana (2008) conducted a study to explore the interrelationships between various critical success factors and group them. They employed questionnaire and interview surveys with construction professionals and used factor analysis to examine the underlying relationships which resulted in the formulation of four-factor groupings which were together called critical COMs of success and were labeled as comprehension, competence, commitment, and communication.

Aksorn and Hadikusumo (2008) held research to identify and quantitatively prioritize the factors contribute to the successful implementation of construction safety programs. They grouped 16 CSF's influencing safety program performance into four dimensions which were worker involvement, safety prevention and control system, safety arrangement, and management commitment. They concluded that the most influential factor is management support.

Yang *et al.,* (2009) didresearch to identify CSFs associated with stakeholder management in construction projects and explore their ranking and underlying relationship. They grouped 15 CSFs into five dimensions related primarily to the planning stage namely: precondition factor, stakeholder estimation, information inputs, decision making, and sustainable support. Their results indicated that the top three ranked CSFs were 1) managing stakeholders with social responsibilities, 2) assessing the stakeholders' needs and constraints to the project, and 3) communicating with stakeholders frequently and adequately.

Chan *et al.,* (2010) held research to explore the critical success factors CSFs necessary to conduct PPP projects. They grouped 18 CSFs into five groups: stable macroeconomic environment; shared responsibility between the public and private sectors; transparent and efficient procurement process; stable political and social environment; and proper government control. They concluded that the most critical factor was seamless and efficient procurement process.

Ling and Bui (2010) to examine factors that lead to successful outcomes in construction projects. They classified the factors into four groups to 1) project related factors, 2) procurement pertaining factors, 3) project management associated factors, 4) characteristics of owners, consultants, and contractors. Their results showed that significant enablers that lead to project success were foreign experts' involvement in the project, government officials inspecting the project, and very close supervision when new construction techniques are employed. They found that the factor which leads to poor performance was the lack of accurate data on soil, weather, and traffic conditions.

Alhaadir and Panuwatwanich (2011) held research to identify CSFs for safety program implementation. They grouped the factors into four categories namely: (1) worker participation; (2) safety prevention and control system; (3) safety arrangement; and (4) safety commitment. They used the Pareto principle, and analytical hierarchical method AHP and suggested seven critical factors that can account for 80% of the successful implementation of safety programs in construction companies which were (1) management support; (2) clear and reasonable objectives; (3) personal attitude; (4) teamwork; (5) effective enforcement; (6) safety training; and (7) suitable supervision.

Zawawi *et al.,* (2011) conducted a study to drive a conceptual framework for describing CSF of building maintenance management. They claimed that the implementing CSF concept would enhance the management process and work planning which would result in the more economicaluse of resources, a corresponding reduction in the total cost and create successful competitive performance organization. In this study, critical success factors were categorized into five primary categories namely: 1.leadership, 2. culture, 3. structure, roles, and responsibilities, 4. system infrastructure, and 5. measurement.

Tan and Ghazali (2011) to determine the CSFs and provide some guidance for contractors needed to operate overseas. They grouped CSF's under seven main categories: (1) project management factors; (2) procurement related factors; (3) client-related factors; (4) design team-related factors; (5) contractor-related factors; (6) project manager -related factors; and (7) business and work environment related factors. Study evidence showed that project management relatedfactor is more important than the other main factors regarding ranking and contractor's experience is the most critical among all the sub-factors.

Famakin *et al.,* (2012) reported the factors affecting the performance of partners in joint ventures construction projects. They grouped CSFs into five groups namely: 1) establishment of joint venture partner's loyalty, 2) commitment to joint venture relationship, 3) maintaining of joint venture organization, 4) establishment of joint venture interests and 5) conflict management. Their study revealed that at the formation stage, compatibility of objectives, mutual understanding, and agreement of the contract are very much crucial to the success of joint venture construction

projects. At the implementation stage, the study also revealed that communication and management control as significant factors at this stage.

Garbharran *et al.,* (2012) conducted a study to assess the perceptions of contractors and project managers on the critical success factors that lead to project success in the construction industry. They used four groups (comfort, competence, communication, and commitment). They emerged that there were no significant differences between project managers and contractors regarding the critical success factors.

Zhao *et al.,* (2013) studied the factors influencing the success of build operate transfer power plant projects. The results showed that there were 14 CSF's at two levels, i.e., macro level and micro level affect the success of these projects. Study results also indicated that the primary success factor of China's built operate transfer electric power projects was the existence of combined efforts from all related stakeholders.

Locatelli *et al.,* (2014) investigated the effect of project characteristics on the success of megaprojects. Locatelli *et al.,* (2014) found out the megaprojects suffer from an abysmal performance like over-budget and behind schedule and, once finished, they deliver fewer benefits than planned. Study results determined main factors needs to be consideredto improve the performance of mega projects which were the participation of internal stakeholders in the company and external stakeholders (like a governmental authority), proper designed project governance, and efficient project delivery chain and project nature.

Fink (2014) held a study to investigate the effect of customer focus competence on construction project performance. He defined customer focus competence as an "awareness of the construction project team members of the customer's importance,

recognizing customer needs and increasing customer loyalty." He found positive effects of the team average customer focus on examined project goals, and it can consideressential factor projects success.

2.10 Relationship between KPIS AND CSFS

Mir and Pinnington (2014) tested the relationship between project management PM performance as CSF and project KPIs. In their research, they demonstrated that PM performance is correlated to project success. And they concluded that by paying more significant attention to this relationship, originations could enhance the performance of their projects.

Cho *et al.*(2009) studied the relationship between project performance and a project's characteristics as CSF. They categorized the project characteristics as project characteristics, owner characteristics, contractor characteristics, and environmental characteristics. Results of the study showed that the project characteristics positively influenced the cost growth and negatively influenced the award rate and 'construction speed. Also, the contractor characteristics positively influenced the unit cost, cost growth, and the schedule whereas the owner characteristics negatively influenced the scheduled growth and positively influenced the 'construction speed. Finally, the environmental characteristics positively influenced the unit and negatively affected the scheduled growth and construction speed.

Omran and Mamat (2011) studied cost performance as KPI of construction projects in Kelantan state located in the east-coast part of Malaysia. The results of their research indicated that the CSFs affecting the cost performances were identified as project manager competence in works affecting cost performance. And they concluded that commitment responsibilities of all participants and various teams to the project were

the top CSF while the presence of poor project specific attributes and not the existence of co-operating and ignorance and lack of knowledge in operating, techniques and decision by project manager were identified as the most critical failure factors.

Chou *et al.,* (2013) defined objectives of a project as the quantifiable criteria that leads to success regarding quality, time and cost. They defined project objectives as success criteria that are quantifiable regarding time, cost, and quality. They used Structural equation modeling was used to determine the effects of PMBOK techniques/tools/skills (TTSs) on project success. They formulated a model and concluded that TTSs improve project success, enhancing project performance, and improving the efficient use of management resources.

Another study in Malaysia done by Alias *et al.,* (2014) to identify the extent of the relationship between CSFs and project performance. They developed a conceptual framework and grouped 61 CSF's for project success in five variables, and they were project management action, project procedures, human factors, external issues and project related factors.

Yang *et al.,* (2015) searched on their study the roles of the CSFs interpersonal conflict, product advantage, and project type in the relationship between requirement quality and stability regarding project performance and market performance. Their results showed that the positive association between requirement quality and durability and project performance depends on some groups, the relationship is stronger for projects with fewer groups than it is for those with more groups. Also, they investigated that training and continuous improvement is the critical definition and management implementation.

2.8 Conceptual Framework

In order to identify KPIs for the success of infrastructure projects in the Sekondi-Takoradi Metropolis, a conceptual framework is proposed to establish where the focus of the KPIs would be. The identified KPIs are intended for project managers because of their overall responsibility for all of the sub-processes within the project stages. The procedure used to compose the proposed framework consisted of a review of relevant literature on the topic to identify the research gaps. This was followed by identifying the main KPIs in developed and developing countries infrastructure projects. The expected outputs are linked with critical success factors and the establishment of KPIs for this extant study. The last part involved interviewing experts in megaprojects management and validating the identified KPIs for this research work that can be used for the success of infrastructure projects.
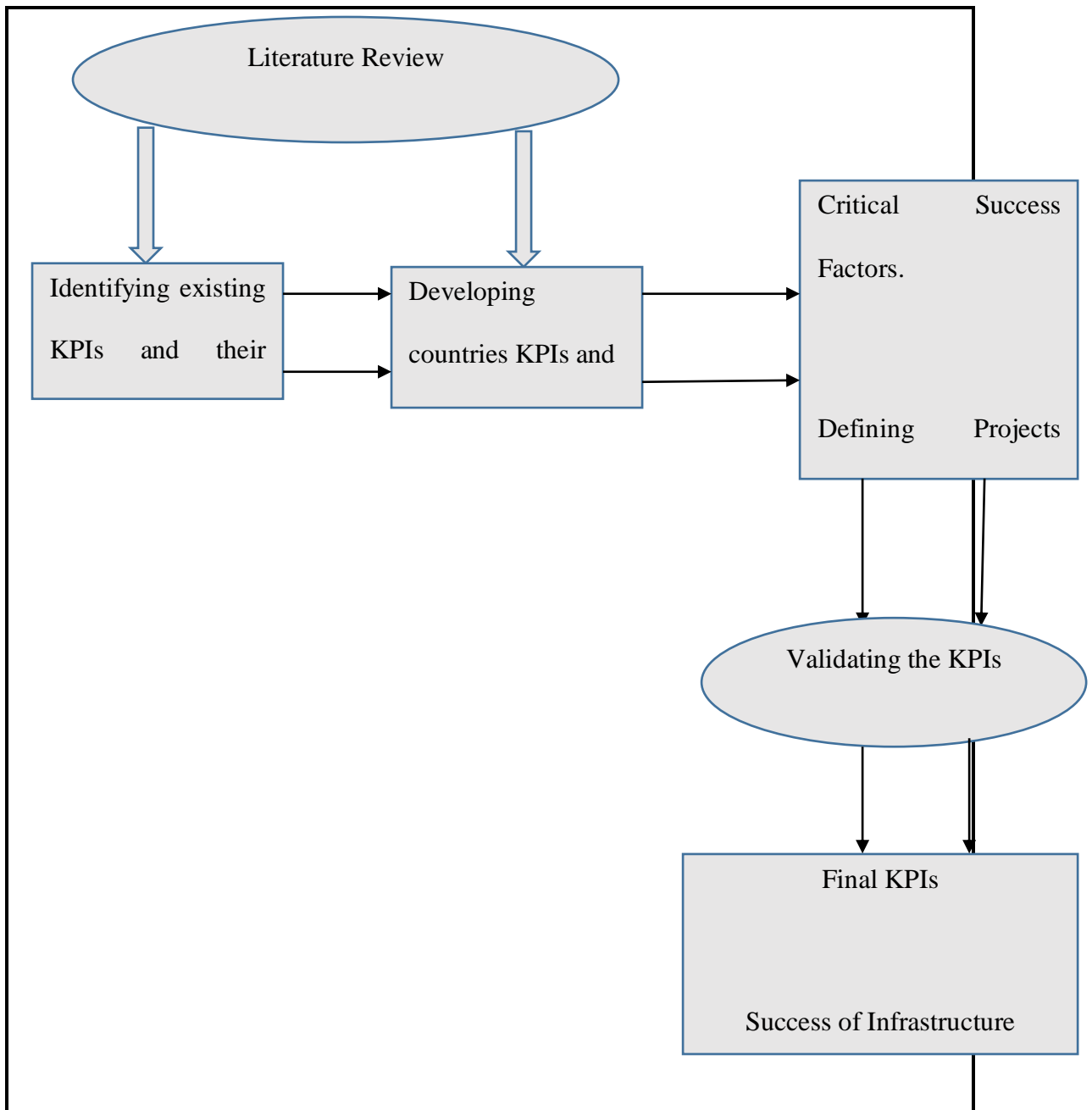
Figure 2.1: Conceptual Framework

Source: Author's construct, (2018)

2.12 summary

The primary objectives of this study are to identify the key performance indicators (KPIs) as success criteria for infrastructure projects. However, the critical success factors CSFs affecting the public construction projects and their relationship with

KPIs in infrastructure construction projects is study. The first section of this chapter conducted studies projects and project management, relevant literature on the topic was studied to identify KPIs in both developing and developed countries studies. The second section reviewed studies concerned about CSFs in developing and developed countries. In the third section studies, the relationship between CSFs and KPIs were mentioned. Investigation of available literature has enforced the need to develop KPIs that will influence the success of infrastructure projects.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

In the previous chapter, the relevant literature on the topic was reviewed to place the research in a sound theoretical context. This chapter is centered on the type of methodology that was used for the successful completion of this research. It explains the research methodology, philosophy, research strategy, research approach, research design, study population, sample size and sampling techniques, research instruments, and data analysis techniques used and how they are appropriate to address the objectives of this research. Thecomplete discussion has been conclusively summarised in this concluding section.

3.1 Research Methodology

The methodology of a research refers to the underlying theory of the research is conducted. It offers the philosophical and theoretical expectations of the study and its consequence on the method or methods adopted for the study (Saunders et al., 2009). It is subsequently used to probe the research problem, collect, analyze and interpret the data (Dainty, 2007).

3.2 Research Philosophy

This research has adopted the positivist approach to research due to the empirical and quantitative nature of the study. Another reason for the choice of this philosophy is the fact that the study has used statistical models and descriptive statistics in explaining the variables. The scientific nature of the study, however, ensures that the

research is positioned towards the value-free end of the axiological context of research philosophy.

Davison and Martinsons (2011) refers to research philosophy as the belief about the way in which data of a phenomenon should be gathered, analyzed and used. The term epistemology (what is known to be true), as opposed to doxology (what is believed to be true), encompasses the various philosophies of research approach (Davison and Martinsons, 2011). Galliers (1991) has indicated that the purpose of science then, involves the process of transforming things believed into things known, i.e., from doxa to episteme. According to Galliers (1991), two major research philosophies have been identified in the Western tradition of science, i.e., positivist, which is also sometimes called scientific, and interpretivist, which is also known as antipositivist.

Positivists believe that reality is stable and can be observed and described from an objective viewpoint (Levin, 1988), i.e., without interfering with the phenomena being studied. The proponents of this view demand a repeatable observation.

According to them, predictions can be made on the basis of the previously observed and explained realities and their inter-relationships. Hirschheim (1985) has said that "positivism has a long and rich historical tradition. It is so embedded in our society that knowledge claims not grounded in positivist thought are simply dismissed as a scientific and therefore invalid". Alavi and Carlson (1992) were in support of this view indirectly.

On the other hand, an understanding of reality fully can be obtained through subjective interpretation of an intervention. The study of phenomena in their natural environment is important to the interpretivists philosophy, together with the acknowledgment that scientists cannot avoid affecting those phenomena they study.

Scientists agree that, interpretation of the reality may be many and these interpretations are inclusive of knowledge of science They admit that there may be many interpretations of reality, but maintain that these interpretations are in themselves a part of the scientific knowledge they are following.

3.3 Research Strategy

The general plan on how the questions of the research are being answered is describe as research strategy as affirmed by Saunders, Lewis, and Thornhill (2009). Remenyi and Williams (2003) affirm that, the strategy of the study directs all the process involved in the conduction of the research. The selection of the right research strategy is dependent on the objectives and the questions relating to the research, the intensity of existing knowledge on the research area, the availability of time and resources and the Saunders et al. (2009) mentioned that appropriate research strategy has to be selected based on research questions and objectives, the extent of existing knowledge on the subject area to be researched, the amount of time and resources available, and the research rational underpinnings.

Easter by-Smith et al. (2008), Collis and Hussey (2009) and Saunders et al (2009) have identified some of the common research strategies used in business and management as experiment, survey, case study, action research, grounded theory, ethnography, archival research, cross-sectional studies, longitudinal studies and participative enquiry. From these various strategies, this research sought to adopt the case study research strategy as the appropriate strategy for research.

The case study as a strategy has been defined by Yin (2003) as an "empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident"

(pp13). The definition put forward by Collis and Hussey (2013), also identified some of the observable characteristics of case study strategy. They defined the case study as "a methodology that is used to explore a single phenomenon in a natural setting using a variety of methods to obtain in-depth knowledge." Therefore, it can be seen that case study research is capable of accommodating different research techniques and is usually used when it is required to obtain in-depth knowledge with regard to a particular phenomenon.

3.4 Research Approach

The inductive research approach was used for this study. According to Bryman and Bell (2015) and Saunders et al. (2012), unapproved conclusion is generated by the usage of premises that are known in inductive inference. Inductive inference generally simplifies from exact to the general.

3.5 Research Design

The blend of time horizon, choices of research thus the mixed or mono-methods and strategies of the research example case study is describe as research design according to Saunders *et al.*, (2009) and thus accomplishment of the objectives of the study is achieved by the provision of exact direction for the relevant procedures as attested by Creswell(2014).

Descriptive survey design was used for this study. According to Cooper and Schindler (2008), a thorough analysis and getting the meaning of a particular phenomenon as it exists in current condition is allowed in a descriptive survey design. A descriptive survey design allows for an in-depth analysis and understanding of a particular phenomenon as it exists in the present condition Kombo and Delno (2009) affirms

that a survey design should be applicable when a research study raises questions that demand interview and questionnaires for the collection of data.

According to Yin (2009), the right design must be used which will tackle the questions about the research and also correlates with the variables.

3.6 Research method

According to Kathori (2004), quantitative, qualitative, and the mixed approach are the three-principle research approach. Conversely, the three main approaches are for exact kinds of research. Qualitative research is defined by Snape and Spencer (2003) as an interpretative method that is based on an individual's understanding given on the occurrence of a particular event in his or her surroundings. Denzin and Lincoln (1998) affirm that, the qualitative research approach is centered on how social meaning is obtained and give emphasis to research topics and researchers. Denzin and Lincoln (1998) affirms that quantitative research is centered on the variables' relationship measurement and analysis. Numerical collection of data is involved in this approach. The numerical of data helps in the explanation, prediction and/or manage interest phenomena. The combination of quantitative and qualitative approaches for a particular study is the mixed approach according to Creswell et al. (2003).It is established by Descombe (2003) that, a researcher must accept the usage of an approach that is unambiguous, appropriate and rational in the quest to achieving result that is accurate.

3.7 Study Population

According to (Mason *et al.*, 1999), the collection of the entire possible individuals, measurement of interest or objects is referred to as population in research. The

population identification helps narrow the objectives down to the specific objects. Construction professionals such as quantity surveyors, project managers, Architects and structural Engineers were the targeted population.

3.8 Sampling and Sampling Technique

A subset of the population that interest a researcher is deemed as a study sample. This can be interpreted as the selected participants for the study. In the selection of a sample, a fairly representation of the population is a prerequisite. The degree at which a researcher can generalise is highly dependent on the sample size and the selection procedure as affirmed by Saunders et al. (1997).Using the convenient sampling technique fifty-two (52) questionnaires were distributed and fifty (50) were retrieved.

3.9 Research Instrument

The study used both the primary and the secondary sources of data in gathering data for the study. The collection of the secondary data was done by the usage of desktop research. The primary data was collected from the various professionals using the questionnaire as the research instrument. Wilkinson and Birmingham (2003) described research instruments as tools that are employed in the collection, translation, and organization of data into valuable information through a systematic and strenuous survey to help in the interpretation of the data. Gray (2004) asserted that the choice of research instrument adopted for a study is dependent on the sort of questions the researcher intends asking and the purpose of the study. Also, other factors such as time and resource also influence the researcher's decision.

The empirical nature of this study dictated that primary data was collected by administering survey questionnaires which were designed after extensively consulting literature (Barako andGatere, 2008; Gomez-Conde, 2015). The consultation of

literature for the development of the questionnaire follows the view of Miller and Yang (2008) that the survey questionnaire can either be developed completely by the researcher or by adopting and/or adapting questions and statements from earlier studies in similar works. Punch (2003), emphasized the merits of using existing questions, indicating that it enables the comparison of past and present results in related research. The researcher in the development of the questionnaire must ensure that personal biases which could offend respondents are not exhibited in the process. In this regard, most of the constructs and the relevant measures in the study were generated and modified to suit the current context from previous.

The questionnaire related to the survey was in three (3) sections and it captured three research objectives. Section one targeted at getting the respondents' background. The other two sections covered issues on the most significant key performance indicators (KPIs) about infrastructure projects delivery in Ghana, and the most significant factors/indicators for measuring project success of infrastructure projects delivery in Ghana.There was a personal administration of the questionnaires to the 60 professional respondents such as architects, quantity surveyors, electrical engineers, mechanical engineers, structural engineers, civil engineers, construction managers, project managers, and construction project managers in the Sekondi-Takoradi metropolis.

3.9 Data Analysis

The analysis of the collected data was key in drawing conclusions on the research. The data was analyzed using frequencies, percentages and charts. This aided in making inferences about the data collected from the respondents. Furthermore, data was analyzed using mean scores to rank based on the significance of the data collected.

3.10 Research Ethics

The ethical issue of validity versus avoiding harm Miles, et al., (2014) is always present while performing a study, thusethical consideration for the research started from research's beginning stage until reporting stage. As part of negotiating access, anonymity and confidentiality were ensured to participants. Their participation was entirely voluntary, and the participants were informed before the interview. And that their identity and details will remain confidential, no personal information was collected other than number of years of experience in their current title/position, project's type and size (based on number of stakeholders), their certification (if any) and their contributions to be used within the context of KNUST MSc. Project Management requirements and would not be disclosed to any third party. They also at any point could refuse to answer any question presented. Thus, interview questions were designed to a certain degree explored participants' experience without diving into confidential information. During the interviews, researchers would not participate or influence participants' perceptions of the subject matter, to ensure data collected were purely participants' perceptions. Finally, researchers would present data collected from participants "as is" without tweaking participants' contributions to match researchers desire results.

3.12 Summary

A detailed methodology used for this study was described in this chapter. It included the first research framework for the study, details of research location, population, and sample size. A detailed questionnaire design was generated. Techniques such as quantitative data analysis, which is inclusive of reliability test, normality test, and Pearson correlation analysis, were designed to be applied by the instruments of SPSS.

To test the research validity, reliability, and adequacy of methods used in the analysis, different statistical tests were used and explained in details.

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND DISCUSSION

4.0 Introduction

The analysis of data, the outcome, the rate of response and respondents' demographic characteristics together with the discussions in reference to the research objective and research methodology are present in the chapter.

4.2 Response Rate

A total of 52 questionnaires were issued. Out of these questionnaires, 50 were returned duly completed. This represents a 96.2% response rate. This was considered a representative sample for further studies according to Mugenda and Mugenda (2003) who report that a rate of 50% and above is acceptable.

4.3 Demographic Characteristics of Respondents

This division was particular about the respondents' demographic characteristics. Gender, age, qualification, years of experience and job title were the demographic characteristics considered.

4.3.1 Gender of Respondents

The researcher sought to establish whether there was a gender balance in the respondents. Table 4.1 depicts the summary of the findings. From the table, it is evident that the construction industry is a male-dominated industry as male represent 68% and female 16%.

Table 4.1:Gender of Respondents

Characteristics	Category	Frequency	Percentage
Gender	Male	34	68%
	Female	16	32%

Source: Field Survey,(2018)

4.3.2 Ages of Respondents

Table 4.2 represents the age distribution of the respondents. The results in the table show that the majority 14 (28%) of the study respondents were below 45-50 years of age, while three were above 60 years of age. This indicates that the majority of the respondents are in their most productive age group. Such respondents are likely to give the true picture of what is on the ground.

Table 4.2: Ages of Respondents

Characteristics	Category	Frequency	Percentage
Age	25-30	3	6%
	30-35	6	12%
	35-40	11	22%
	45-50	14	28%
	55-60	13	26%
	Above 60	3	6%
	Total	**50**	**100%**

Source: Field Survey,(2018)

4.3.3 Highest Level of Education

The perception levels of the respondents were achieved to some extent by querying the respondents about their highest level of education as to aid the researcher to understand the answers given to the subsequent sections. Table 4.3 and Figure 4.1 shows the results.

Table 4.3: Highest Level of Education

Highest Level of Education	Frequency	Percentage
Doctorate	2	4%
Masters	6	12%
Degree	32	64%
Diploma	6	12%
Other	4	8%
Total	**50**	**100%**

Source: Field Survey,(2018)
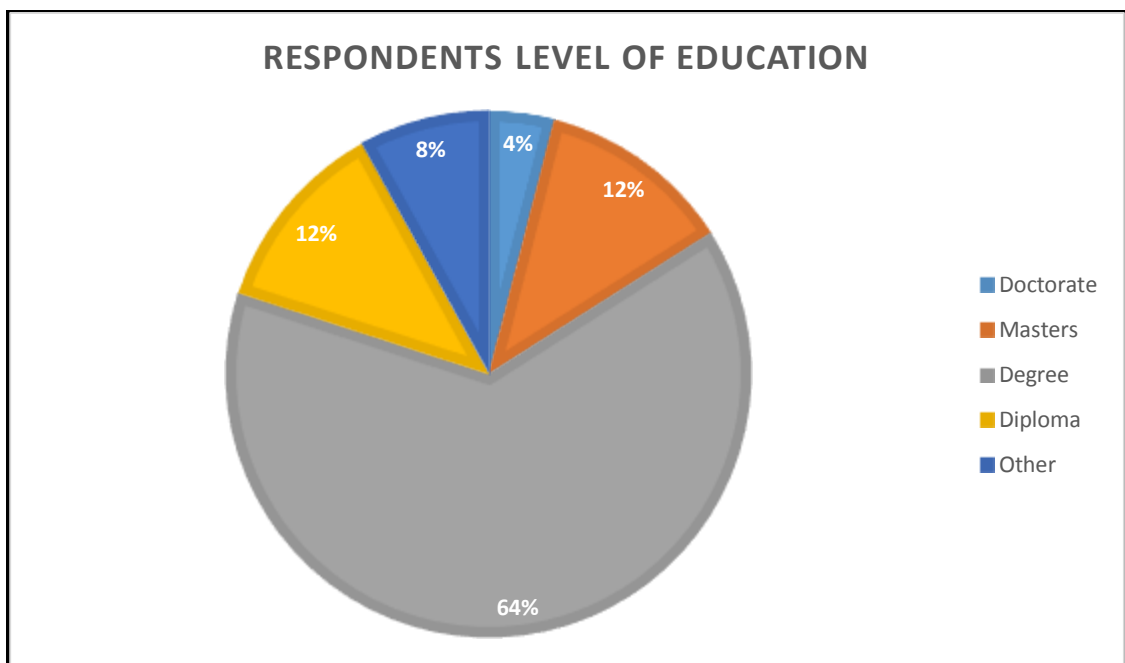
Figure 4.1: Respondents level of education

Source: Field Survey,(2018)

From the findings 64% of the respondents had a degree; 6% had masters and diploma; 6% had masters; 4% had a doctorate degree, and 8% had other educational qualification. It was concluded that a majority of the respondents had degrees and diplomas. Hence they are in a better position to give good responses.

4.3.4 Years of experience

The study sought to determine the number of years of service of the respondents to establish whether they had attained adequate expertise to provide accurate and reliable information. Table 4.2 outlines the results.

Table 4.4 Years of experience

Years worked	Frequency	Percentage
Less than 5 years	3	6%
5-10 years	15	30%
10-15 years	12	24%
15-20 years	17	34%
Above 20 years	3	6%
Total	**50**	**100%**

Source: Field Survey,(2018)

The results show that 6% of the respondents had worked for less than 5 years; 30% of the respondents had worked for between 5 – 10 years. 24% of the respondents had worked for 10 – 15 years; 34% of the respondents between 15 -20 years and 6% had worked for more than 20 years.

4.3.3 Job Title

The study sought to establish the job title of the respondents at the workplace. This can help develop a relationship between the role of the respondents and levels of cost-cutting strategies. Table 4.5 shows the results.

Table 4.5: Job Title of Respondents

Job Title	Frequency	Percentage
Project Consultant	3	6%
Engineer	19	38%
Architect	7	14%
Quantity Surveyor	11	22%
Project Manager	6	12%
Other	4	8%
Total	**50**	**100%**

Source: Field Survey,(2018)

From the results in Table 4.5, 6% projectedconsultant; 38% were engineersof various engineering disciplines; 14% were an architect; 22% were quantity surveyors; 12% were the project manager and 8% in other level. This is in line with the population distribution of the study which showed that the majority of the population is in the engineering cadre.

4.4 Findings of the Main Objectives

In this section, descriptive statistics were presented. The descriptive statistics used were frequencies and percentages, while the inferential statistics used were mean scores.

4.4.1 Key Performance Indicators (KPIs) About Infrastructure Projects

The first objective was to identify the most significant key performance indicators (KPIs) about infrastructure projects delivery in Ghana. Table 4.5 depicts the summary of the finding in relation to the first objective.

Table 4.6 Key Performance Indicators (KPIs)

Most Significant KPIs			
	Mean	**SD**	**Rank**
Financial KPIs	4.30	0.016	1st
Construction Products KPIs	4.30	0.018	2nd
Repairs KPIs	4.30	0.110	3rd
Total Quality Management KPIs	4.30	0.121	4th
Rethinking Construction KPIs	4.20	0.110	5th
UK KPIs Working Group KPIs	4.20	0.112	6th
Danish Construction KPIs	4.20	0.120	7th
USA Construction industry KPIs	4.10	0.012	8th
Consultants KPIs	4.10	0.100	9th
M and E Contractors KPIs	4.10	0.120	10th

Source: Field Survey,(2018)

From table 4.6, financial KPIs (mean = 4.3); Construction Products KPIs (mean = 4.3); Total Quality Management KPIs (mean = 4.3) were identified as the most significant KPIs about infrastructure projects delivery in Ghana. Key performance indicators are measurable indicators that demonstrate the level of achievement in a project. KPIs provide information to the decision makers to measure performance and to compare them with the intended outputs, outcomes, goals, and objectives and were chosen to reflect the success criteria of a project (Omran and Mamat, 2011). The purpose of the KPIs is to enable measurement of the project and organizational performance. The process of developing KPIs involved the following issues (Chan and Chan, 2004).

4.4.2 Most Significant Indicators for Measuring Project Success in Ghana

The respondents were also asked to indicate the most significant success criteria. Based on the responses, quality was ranked first. Quality is to be assessed in both preconstruction and construction phases as it forms the ''iron triangle'' with time and cost that is fundamental KPI of the project (Chan *et al.*, 2002). Final product quality and process quality that meet and exceed owner requirements are an important part of project success (Li *et al.*, 2012). Sanvido *et al.,* (1992) defined the quality defined as the totality of features, attributes, and characteristics of a facility, product, process, component, service, or artistry that bear on its ability to satisfy a given need: fitness for purpose. Another close definition of quality used by Lam *et al.,* (2007) and Ling and Bui (2010) were that quality is the output quality of the service rendered or work is done from the technical and artistry aspects. Chou *et al.,* (2013) considered the quality as performance outcome.

Time and cost were ranked 8th and 9th. Performance in relation to cost is as essential to the entire construction parties as performance in relation to cost (Meeampol and Ogunlana, 2006). Predictably completing a project, on time, within schedule is a critical KPI (Li *et al.*, 2012). Time is defined as the degree to which the general conditions promote the completion of a project within the allocated duration (Chan *et al.*, 2002; Lam *et al.*, 2007). It is measured by using overrun of the time, construction time, and construction speed (Chan *et al.*, 2002). Cost is defined as the degree to which the general conditions promote the completion of a project within the estimated budget (Chan *et al.*, 2002; Omran and Mamat, 2011; Lam *et al.*, 2007). It can be measured by the cost overrun and unit cost (Chan *et al.*, 2002). Specifically, regarding unit cost, the percentage of net variation over the final cost (Chan and Chan, 2004). Chou *et al.,* (2013) considered the cost refers to the budget.

Cost performance is the most important indicator of project success used by all parties (Li *et al.*, 2012). It presents the firm's profitability, productivity and is always used to measure project performance against the estimated target (Meeampol and Ogunlana, 2006; Memon *et al.*, 2013). In the quest to achieve success throughout the phases of the project, cost and time should be measured at the start of the construction through to the construction phases of the project. time and cost should be constantly kept under the watch to avoid delays(Chan *etal.*, 2002). Delays should be avoided as any delay caused brings in an increase in the construction cost. (Meeampol and Ogunlana, 2006; Ahsan and Gunawan, 2010).

Table 4.7 Most Significant Indicators for Measuring Project Success in Ghana

Success Factor			
	Mean	**SD**	**Rank**
Quality	4.40	0.012	1st
Transfer of experience and best practice	4.30	0.050	2nd
Stakeholders Satisfaction	4.20	0.120	3rd
Health and safety	4.20	0.126	4th
Environment	4.20	0.132	5th
Economic (stable economic conditions and economic policy)	4.20	0.146	6th
Risk Management	4.20	0.245	7th
Time	4.20	0.262	8th
Cost	4.10	0.010	9th
Project organization structure	4.10	0.018	10th

Source: Field Survey,(2018)

4.4.3 Effects of Significant Key Performance Indicators and Project Success

The respondents were asked to indicate the effects of KPIs on project success. From the responses, financial KPIs was ranked first. Omran and Mamat (2011) studied cost performance as KPI of construction projects in Kelantan state located in the east-coast part of Malaysia. The results of their research indicated that the CSFs affecting the cost performances were identified as project manager competence in works affecting

cost performance. And they concluded that commitment responsibilities of all participants and various teams to the project were the top CSF while the presence of poor project specific attributes and not the existence of co-operating and ignorance and lack of knowledge in operating, techniques and decision by project manager were identified as the most critical failure factors.

Table 4.8: Relationship betweenkey performance indicators and project success

Effects of KPI on project success	Mean	SD	Rank
Financial KPIs	4.40	0.120	1st
Construction Products KPIs	4.30	0.110	2nd
Consultants KPIs	4.30	0.112	3rd
Total Quality Management KPIs	4.20	0.346	4th
Rethinking Construction KPIs	4.20	0.420	5th
UK KPIs Working Group KPIs	4.20	0.540	6th
Danish Construction KPIs	4.20	0.621	7th
USA Construction industry KPIs	4.20	0.666	8th
Repairs KPIs	4.10	0.111	9th
M and E Contractors KPIs	4.10	0.124	10th

Source: Field Survey,(2018)

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0 Introduction

This chapter discusses and analyses the empirical findings and data critically as presented in chapter four. The section is divided into two sections. The first part summarizes the empirical on key infrastructure projects KPIs. The second section deals with the conclusions from the findings and the third session give a general recommendation for the government of Ghana and project managers to implement to help curb the delays and completed infrastructure projects across the country.

5.1 Summary

The study has covered a broad range of KPIs from the construction industry extensively. The review shows that there are many existing KPIs, a situation which makes it difficult for entities with little experience of KPIs to choose suitable KPIs for measurement. Despite the many different KPIs seen in the review, it is apparent that some of the measures are used more often in the KPIs in use. The more commonly occurring KPIs could be the basis for the KPIs to be developed for Ghanaian contractors. Especially for the infrastructure projects related to KPIs, there seems to be a common theme with measures such as triple constraints, i.e. Time, Cost, and Quality.

5.2 Conclusion

The literature review on performance indicators showed that, the scope and quality were the most important KPI for infrastructural projects. From the analysis of collected data, it was realized that, construction schedule, profitability, project management, material ordering, handling and management are the most significant

performance indicators for construction projects in Ghana. Therefore, it can be concluded that, construction firms should endeavor to enhance their competencies in order to enhance their capabilities of achieving high notes on the performance indicators.

5.3 Recommendations

From the conclusions drawn, the following recommendations are made for consideration as means of improving contractors' performance on key infrastructure projects in the Sekondi-Takoradi metropolis:

i. Benchmarking KPIs for project portfolios

ii. KPIs reviews of the process regarding deviations

iii. Focus on quality for all infrastructure projects

iv. Employee satisfaction index should be employed on all key infrastructure projects.

5.4 Further Work

As follow up to recommendations given above the following research are proposed for

consideration in future.

i. Comparison of performance of Contractors on projects awarded using the lowest bidder and that of Contractors selected using other methods.

ii. Detailed analysis of effect/impact of individual identified factors on Contractors."

Performance.

iii. Identify reasons why some government institutions/establishments are not using the guidelines spelled out in the Public Procurement Act in the selection.

5.5 Limitation of the Study

This study is limited to the following:

1. The research is limited to the infrastructure construction projects in the Sekondi-Takoradi Metropolitan area.

2. The research is based on quantitative analysis including questionnaire only.

3. The research sample targeted the construction experts working in governmental organizations, nongovernmental organizations and consultant offices.

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KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

COLLEGE OF ART AND BUILT ENVIRONMENT

DEPARTMENT OF BUILDING TECHNOLOGY

<u>QUESTIONNAIRE</u>

RESEARCH TOPIC: *THE INFLUENCE OF KEY PERFORMANCE INDICATORS (KPIs) ON PROJECT SUCCESS: CASE STUDY OF SELECTED INFRASTRUCTURE PROJECTS IN SECONDI-TAKORADI METROPOLITAN AREA*

Dear Respondent,

I am a student of Kwame Nkrumah University of Science and Technology pursuing a Master of Science degree in Project Management. The questionnaire is intended to help the researcher get information on the influence of key performance indicators (KPIs) on project success on some selected infrastructure projects in Secondi-Takoradi Metropolitan area. The purpose of the study is purely academic and information given will be treated with the highest degree of confidence. You have been selected as a key respondent for this study. Kindly, complete the questionnaire to enable the researcher complete the study. The research is under the supervision of Dr. De-Graft Owusu Manu. Please tick the answer which represents your opinion on the subject.

I appreciate your participation in this effort. Thank you.

Yours Sincerely,

Charles Animi, MSc. Student, KNUST

Dr. De-Graft Owusu-Manu, Project Supervisor, Department of Building Technology (KNUST)

SECTION ONE: DEMOGRAPHIC BACKGROUND OF RESPONDENTS

Please, kindly respond to the questions by ticking (√) the appropriate box for each item.

---

1. Gender: [ ] Male [ ] Female

2. Age: [ ] 25-30 [ ] 30-35 [ ] 35-40 [ ] 45-50 [ ] 55-60 [ ] Above 60

3. Qualification: [ ] HND [ ] BSc [ ] MSc [ ] PhD [ ] Other ………………….

4. Years of experience: [ ] Less than 5 years [ ] 5-10 years [ ] 10-15 years [ ] 15-20 years

[ ] Above 20 years

5. How would you best describe your role? [ ] Project Consultant [ ] Engineer [ ] Architect [ ] Quantity Surveyor [ ] Project Manager [ ] Other…………...

SECTION TWO: MOST SIGNIFICANT KEY PERFORMANCE INDICATORS (KPIS) ABOUT INFRASTRUCTURE PROJECTS

Kindly, indicate your level of the agreement or disagreement with the following statement on the most significant KPIs about infrastructure projects.
[1=Strongly disagree; 2= Disagree; 3= Neither agree nor disagree; 4= Agree; 5=Strongly agree]. Please tick (√) in the space provided.

Most Significant KPIs	1	2	3	4	5
1. Financial KPIs					
2. Rethinking Construction KPIs					
3. UK KPIs Working Group KPIs					
4. Danish Construction KPIs					
5. USA Construction industry KPIs					
6. Construction Products KPIs					
7. Repairs KPIs					
8. Total Quality Management KPIs					
9. Consultants KPIs					
10. M and E Contractors KPIs					
Others (please identify any not in list)					

SECTION THREE: **MOST SIGNIFICANT FACTORS/INDICATORS FOR MEASURING PROJECT SUCCESS OF INFRASTRUCTURE PROJECTS**

Kindly, indicate your level of the agreement or disagreement with the following statement on most significant factors/indicators for measuring project success of infrastructure projects.

[1=Strongly disagree; 2= Disagree; 3= Neither agree nor disagree; 4= Agree; **5=Strongly agree]**. Please tick (√) in the space provided.

Success Factors	1	2	3	4	5
1. Time					
2. Cost					
3. Stakeholders Satisfaction					
4. Health and safety					
5. Environment					
6. Quality					
7. Economic (stable economic conditions and economic policy)					
8. Transfer of experience and best practice					
9. Risk Management					
10. Project organization structure					
Others (please identify any not in list)					

SECTION FOUR: EFFECT OF KPIs PROJECT SUCCESS.

Kindly, indicate the significance of the following KPIs on project success.

[1=Not Important; 2=Slightly Important; 3=Somewhat important; 4=Moderately important; 5=Very Important]. Please tick (√) in the space provided.

KPIs	1	2	3	4	5
Financial KPIs					
Construction Products KPIs					
Consultants KPIs					
Total Quality Management KPIs					
Rethinking Construction KPIs					
UK KPIs Working Group KPIs					
Danish Construction KPIs					
USA Construction industry KPIs					
Repairs KPIs					
M and E Contractors KPIs					
Others (please identify any not in list)					