
Charles Kiteme Mbiti
Jomo Kenyatta University of Agriculture and Technology

Abstract: The study sought to determine the factors influencing effective implementation of megaprojects in Kenya. The specific objectives of the study were to assess the effect of building information modelling technology, top management support, stakeholder participation and project team competency on the effective implementation of megaprojects in Kenya. The target population of the study was all the 1,644 project experts employed by China Road and Bridge Corporation on the standard gauge railway project between the year 2016 and 2017. The experts consisted of 852 Chinese managers and 692 Kenyan managers. A list of all the 1,644 experts from the main Contractor formed the sampling frame. The study employed random sampling technique to select a sample size of 164 railway experts from the total of 1,644 from China Road and Bridge Corporation. Structured questionnaires were used to collect data. The research instrument was piloted on 17 respondents to ascertain its reliability. The 17 respondents were 10% of the sample size of 164 subjects. The research used an internal consistency measure known as Cronbach’s Alpha (α) generated by SPSS version 22. The study found a reliability coefficient of 0.896 against the acceptable value of Alpha (α) of 0.7 used as a threshold of reliability for this study. The sample size of 164 experts represented 10% of the 1,644 railway experts. Primary data was collected from the project managers at the various sections of the project from Mombasa to Syokimau terminal Nairobi. Secondary data was collected from the library by reading relevant topics from journals and books. Primary data was collected by use of self-administered questionnaires. Data was collected during the implementation of the SGR project. Quantitative data analysis involving descriptive and inferential statistics were used to analyze the data collected. Descriptive statistics included frequencies distribution tables and percentages. Inferential statistics included use of multiple linear regression model and correlation. Results were presented in form of tables and pie charts. Qualitative data was analyzed through content analysis and presented in continuous prose form. The study was governed by four theories; Competency theory, Stakeholder, Goal Setting Theory of Task Performance and the theory of project management. The effect of building information modelling, top management support, stakeholder participation and project team competency on the effective implementation of standard gauge railway project was deduced from the results of the study. The findings of the study concluded that building information modelling, stakeholder participation and project team competency influence the effective implementation of megaprojects in Kenya. The study could not establish the influence of top management support on the Effective Implementation of megaprojects in Kenya since the relationship between the variables was found to be weak and not statistically significant.

1. Introduction

‘Mega projects’ is a concept of growing importance in globally connected business environments (Kardes, Ozturk, Cavusgil & Cavusgil, 2013). Mega projects are large-scale, complex business ventures that cost a billion dollars or more, take many years to develop and implement and involve multiple public and private stakeholders (Flyvbjerg, 2014). Mega projects are experiencing great interest across the world as a tool for urban renewal and are increasingly common around the world. Large scale urban developments has evolved from a focus that is singular and monolithic to a focus that is flexible and very diverse. Mega projects are designed to escalate structural change and are very complex to manage. Since the era up to the 1950s the global landscape has changed drastically. Mega projects have been used traditionally to describe large scale capital investments such as transportation networks and power facilities. The new mega projects take the form of vast complexes with a mix of uses, various financing techniques and a combination of public and private sector initiators (Flyvbjerg, 2014). The new kind of urban mega projects involves a wholesome transformation of urban space and completely changes the social practices in these urban landscapes. Mega projects are increasingly used as a delivery model for goods and services across diverse businesses and sectors. These sectors are water, energy, infrastructure,
information technology, industrial processing plants, mining, supply chains and enterprise systems. Other business areas for mega projects are strategic corporate initiatives, change programs, mergers, acquisitions, government administrative systems, banking, defense, intelligence, air and space exploration, big science, urban regeneration and major events. Typical examples of mega projects are high-speed rail projects, airports, seaports, motorways, hospitals, pension ICT systems, national broadband, the Olympics, dams, large-scale signature architecture, wind farms, offshore oil and gas extraction, aluminum smelters, the development of new aircrafts, the largest containers and cruise ships, high energy particle escalators and the logistics systems used to run large supply-chain-based organizations like Maersk and Amazon (Flyvbjerg, 2014). The financial significance of megaprojects is self-evident: they consume large amounts of capital that is invested for the provision of efficient public infrastructure. Whether publicly or privately funded, project sponsors look for efficient deployment of capital to produce successful projects (Jin, Lee & Zhang, 2011).

1.1.1 Global Perspective of Construction Project Implementation

The mounting of very large development projects (mega-projects) has been witnessed recently across in European and American cities. The developments have striking similarities in private –sector involvement and market orientation but differ in how they provide affordable urban and tie physical and social goals. Public-private partnerships are seen globally to provide public benefits from mega-projects though the projects are seen as risky for both public and private participants and therefore must be intended to achieve profitability and produce a landscape that discourages urbanity (Paquin, 2001). Globally the appraisals of very large infrastructure investments assume that infrastructure policies and projects operate in a predictable cause-effect relationship where things go according to plan. In reality, project initiation, planning, implementation and closure is very complicated with deliverables being achieved only with a certain probability and rarely to the scope originally intended (Flyvbjerg, Bruzelius & Rothengatter, 2003). The conventional approach to infrastructure projects is replaced with an alternative focusing on accountability.

The borderlines of public and private involvement in mega project has been redrawn globally with four specific measures to increase accountability: transparency, performance specifications, explication of regulatory regimes and involvement of risk capital. The decision to build a multi-billion dollar fixed link across the Baltic Sea connecting Scandinavia and Germany was based on the four measures of accountability and can be replicated globally in other major projects (Flyvbjerg, Bruzelius & Rothengatter, 2003). The American Interstate Highway Project is the largest mega project in the world (Schwantes, 2003). Mega-projects are seen to create several jobs and develop the economy within a short span of time (Paquin, 2001). The architecture, engineering and construction (AEC) industry has embraced improvement in technology with advances in information and computer technology (Sabol, 2008).

The architecture, engineering and construction (AEC) industry developed Building Information Modelling (BIM) technology to aid in construction project implementation. The technology develops an accurate virtual model of a building digitally called building information model which is used for planning, design, construction and operation of the building (Azhar, 2011). BIM technology has made it possible for architects, engineers and constructors to visualize 3-dimensional building designs in a simulated environment. BIM technology identifies potential design, construction or operational challenges and assists project managers to mitigate the project risks globally. Sabol (2008) explains that BIM technology integrates the roles of all stakeholders on a project and is a new dominating paradigm within AEC industry. BIM is a drawing and documentation tool that offers a platform for enhanced collaboration, change management and information support throughout the building lifecycle. The majority of the industry is using some form of BIM technology (Azhar, 2011).

The urge to build something bigger and better than has ever been done before has always been a driving force behind the human race’s relentless pursuit of technological advancement (Parrock, 2015). It is in this vein that mega projects have evolved over time, as methods of construction improved, so did the scale on which people could attempt new projects. The Channel Tunnel between England and France, the Hoover Dam in America and the Millau Viaduct in the French countryside are some of the biggest examples of infrastructure projects in the world and these are all unequivocally, mega projects. Mega-projects continue to inspire and motivate artists and engineers globally. According to Elbanna (2013) the implementation of 65 per cent of megaprojects implementations in the world results in failure.

1.1.2 Local Perspective of Construction Project Implementation

The construction industry in Kenya has experienced a rapid expansion supported by a robust growth in property development, a growing real estate sector and the on-going mega infrastructure
projects (ESR, 2015). Kenya has experienced a thriving construction industry in recent years according to the Kenya National Bureau of Statistics. The construction industry’s gross value added grew by 13.6 per cent and 13.1 per cent in the year 2015 and 2014 respectively compared to 5.8 per cent growth in the year 2013 (ESR, 2016). The Kenyan government has initiated several major projects since the 2014/15 financial year. These projects include the Standard Gauge Railway project from Mombasa port to Malaba boarder covering 962KM. Replacement of line 5 of the Mombasa-Nairobi 450KM pipeline with a new 20 inches diameter pipeline at a cost of US$500 million began in 2014/15 financial year and is going on. Construction of Terminal 1A at Jomo Kenyatta International Airport was commissioned in the year 2014/15 (ESR, 2015). The energy sector grew by 6.8 per cent in 2014 compared to a growth of 9.8 per cent in 2013 due to suppressed long rains that led to a contraction of 19.5 per cent in hydro generation.

Geothermal power generation grew by 63.8 per cent in 2014 due to expanded installed capacity with the commissioning of 140MW geothermal plants at Olkaria IV and wellheads. The overall increase in electricity generation stood at 8.2 per cent in 2014 against an increase of 7.6 per cent in the year 2013. Formal sector employment in the building and construction industry grew by 11.4 per cent in 2015 to stand at 148,000 personnel from 132,900 personnel in the year 2014. Construction of SGR and roads greatly contributed to the growth in employment in the construction industry. The index of government expenditure on roads increased from 263.4 in 2014 to 386.7 in 2015 to support all the projects being undertaken during the year. Cement consumption went up by 9.9 per cent from 5,196.7 thousand metric tons in 2014 to 5,708.8 thousand metric tons in 2015 (ESR, 2016). In Kenya, delays in the implementation of infrastructural facilities have been associated with factors such as poor financial management by government agencies, inadequate designs and poor management of the construction process by contractors. Arguably, these factors are compounded by secondary factors, such as poor management of materials and equipment by contractors, inadequate recognition and response to risks emanating from the physical and socio-economic environments, as well as inadequate regard for stakeholders’ needs.

1.1.3 Standard Gauge Railway Project

SGR project consist of various phases. These starts with the construction of phase 1 of the Standard Gauge Railway (SGR) at KShs 327 billion for the 609KM from Mombasa to Nairobi set to be commissioned on July 2017. Construction of the 120KM rail for phase 2A of SGR was started in 2016 and is estimated to cost KShs 143.8 (USD 1.5 billion) billion to Naivasha. The next phase of SGR is 262KM, phase 2B and starts from Naivasha through Narok to Bomet and ends at new Kisumu port. Phase 2B of SGR will involve the construction of a new high capacity port at Kisumu city and is at feasibility stage. The last phase of SGR is 107KM, phase 2C.

It is expected to start at the new Kisumu port and end at Malaba boarder with a provision for further extension to Uganda. It is at feasibility study. On 1st October, 2009, the governments of Kenya and Uganda signed a MoU for construction of the SGR from Mombasa to Kampala. The SGR took a regional dimension after the signing of this MoU with Uganda (APEC Consortium Limited, 2015). Kenya, Uganda and Rwanda governments signed a Tripartite Agreement in 2013 committing to fast track the development of the railway to their respective capital cities. South Sudan has since come on board as an interested stakeholder in the project.

Regional economic interests have therefore worked in favor of the project (RoK, 2014). In this regard, the SGR line will snake its way from the port of Mombasa to Kigali through Kampala with a branch line to Juba. The Kenya Railways Corporation (KRC) is the implementing agency of the SGR, while China Road and Bridge Corporation is the main contractor (RoK, 2014). The World Bank expected Kenya’s economic growth to rise to 5.7 per cent in 2016 spurred by government infrastructure projects. The bank forecasts that the economy will pick up to 6.1 per cent growth in 2017 and 2018 as the standard gauge railway (SGR) and the Lamu Port come into operation.

1.2 Statement of the Problem

Despite the challenges facing the building and construction industry, the sector has recorded significant growth (ESR, 2015). The Kenyan AEC sector is faced with myriads of challenges ranging from collapsed buildings, uninspected houses to substandard buildings. Actual expenditure on housing by the National housing Corporation went down to KSh 5.9 billion in 2014/15 from KSh 6.1 billion in 2013/14 due to fewer projects completed (ESR, 2016). Housing projects completed were worth KSh 5.9 billion against an approved expenditure of KSh 7.4 billion for the financial year 2014/15 (ESR, 2016). The coefficient of determination for construction projects in Tanzania is 0.2762 showing that 27.62% of the variations in cost overruns are attributed to schedule overruns. Korir (2013) established that poor performance of construction projects in Kenya leads to project delays of up to 184.7% and cost overruns of up to 152.3%. Kogi (2013) established that project
cost overrun is a persistent problem in the construction industry and recommended that measures be taken to control project costs. Gacheru (2015) attribute building collapse to poor designs, non-compliance to specifications, cost cutting by contractors, use of substandard material unqualified technicians, poor or lack of quality control and incompetent contractors. A study of major projects in Kenya has shown that almost all projects suffer from poor quality deliverables, schedule and cost overruns (Kibuchi, 2012). Githenya and Ngugi (2014) established that project control measures significantly determined the implementation of housing projects in Kenya with a correlation coefficient of 76.6 per cent. The study recommended that project managers take adequate control measures over every aspect of the project.

A study by Gacheru (2015) established that even the regulator of the Kenyan building and construction industry, National Construction Authority (NCA) is facing challenges of lack of capacity in human resource and fails to regularly inspect construction projects. Studies done to investigate factors influencing building completion of building projects in Kenya established a positive relationship between completion of building projects and business related factors, project procedures, project management factors and human related factors (Wanjau, 2015). This study sort to investigate the determinants of effective implementation of county construction projects in Kenya.

1.3 Objectives of the Study

1.3.1 General Objective

The purpose the study was to determine the factors influencing effective implementation of megaprojects in Kenya.

1.3.2 Specific Objectives

The specific objectives of the study were:

1) To assess the effect of building information modelling on effective implementation of megaprojects.
2) To establish the effect of top management support on effective implementation of megaprojects.
3) To determine the effect of stakeholder participation on effective implementation of megaprojects.
4) To establish the effect of project team competency on effective implementation of megaprojects.

1.4 Research Questions

1) How does building information modelling affect effective implementation of megaprojects?
2) How does top management support affect effective implementation of megaprojects?
3) How does stakeholder participation affect effective implementation of megaprojects?
4) How does project team competency affect effective implementation of megaprojects?

2.0 Literature Review

This section explored on the literature related to the study. It covered the theoretical literature review, empirical literature review, and critical review of literature. The section also covered a critique of the existing literature relevant to the study, summary of literature and research gaps.

2.1 Theoretical Review

Various researchers have formulated theories and models that explain how best to effectively implement megaprojects in a manner that should ensure that all the project goals are met within the constraints of time, cost, quality and scope through their studies on the theories and models. The relationship between the various factors influencing effective implementation of megaprojects was explained by these theories: Competency theory, Stakeholder, Goal Setting Theory of Task Performance and the theory of project management. These theories argued out and explained the factors influencing effective implementation of the SGR project in Kenya.

2.1.1 Theory of Project Management

Koskela and Howell (2002) explored the theoretical foundation of project management as espoused in the PMBOK by PMI. The theory of project management was developed by Koskela and Howell (2002) consists of two theories: the theory of project and the theory of management. The theory of project looks at the transformation view on operations.

The theory of project conceptualizes a project as a transformation of inputs to outputs and explains the existence of a number of principles by which a project can be managed. The theory considers a project as a decomposition of the total transformation hierarchically into smaller transformations, tasks, subtasks and minimizes the cost of each task independently. The theory of management by Koskela and Howell (2002) is explained by three theories; management-as-planning, the dispatching model and the thermostat model. Management-as-planning is the management at operational level and consists of the creation, revision and implementation
of plans. Management-as-planning explores a strong causal relationship between the actions of management and outcomes of the organization. The dispatching model of management considers that planned tasks can only be executed by a notification of the commencement of the task to the task executor.

The thermostat model consists of the following components: a standard of performance; a criteria to measure performance at the output. The theory of management postulates that the variance between the standard and the measured value can be used to correct the process to meet the standard value (Koskela & Howell, 2002). Megaprojects have a life cycle that consist of project initiation, project design, planning, implementation, monitoring and closure (PMI, 2013). In the context of this study, megaprojects undergo transformation through a life cycle. The Standard Gauge Railway (SGR) project was initiated, designed and planned and is under implementation in phases. Project inputs for the SGR execution are in form of finances from Exim Bank of China that provided 90 per cent of the funds amounting to KShs 294.3 billion. The remaining 10 per cent of the KSh 327 billion has been provided the government of Kenya. This amount is paid by Kenyan taxpayers through the railway development levy and amounts to KShs 32.7 billion. The Kenyan taxpayer expects project finances to be used effectively to enable effective implementation of the Standard Gauge Railway project.

The completion of the SGR project is dependent on the achievement of the projected deliverables by transforming inputs to outputs through topnotch project management as illustrated by the project management theory (Koskela & Howell, 2002).

### 2.1.2 Competence Theory

The competence theory was developed by McClelland & McBer in the 1980s. The authors defined competency as the underlying characteristic of an individual that is causally related to criterion-referenced effective and/or superior performance in a job or situation. Since then a number of competency frameworks have been developed by different project management institutes. The theory postulates that the core competencies enable the firm to develop the requisite techniques, expertise, systems and infrastructure to provide quality products and services satisfy the needs of its customers (Prahalad & Hamel, 2006).

The theory explain that integration of multiple technologies and coordination of diverse production skills assist firms to create value in its products and services. The theory is used to develop a strategy to use the core competencies of the organization to meet customer needs and gain competitive advantage over its competition (Prahalad & Hamel, 2009). In the context of this study, the author assumes that the SGR project team are personnel who have the requisite project management competencies to manage the complex megaproject effectively to satisfy the needs and expectations of all stakeholders.

### 2.1.3 Stakeholder Theory

Stakeholder theory was developed by Ian Mitroff in 1983 and later advanced by Freeman in late 1983. The theory postulates that the relationship between project stakeholders and the organization is one that is designed to create value for the stakeholders. The theory explains how to manage the various interests of the legitimate stakeholders that exist in a project.

There are stakeholders who have contractual obligations and derivatively legitimate stakeholders whose relationship to the project is derived from their ability to affect the project work, organization or other stakeholders (Kolesnikov, 2014). Implementation of megaproject deliverables is critically dependent upon stakeholder management skills. The need to achieve project objectives that fully address stakeholder expectations throughout the project life-cycle is of priority concern to the project team. However, one major task that needs to be undertaken in developing a project’s strategic aims is to identify stakeholders in order to develop a project brief that best addresses their often conflicting range of needs and wishes (Kolesnikov, 2014).

The theory is based on the principle that project managers must connect into the organizational grid, identify key stakeholders and their value propositions in a project and manage them. In the context of this study, megaproject managers are unlikely to deliver project success without paying attention to the expectations and needs of key influential project stakeholders. The stakeholders may cumulatively exert a significant impact on the perception of project success. A project that does not meet expectations of influential stakeholders is not likely to be regarded as successful, even if it remains within the original time, budget and scope. This theory guides stakeholder management in the standard gauge railway project for effective implementation of SGR project.

### 2.1.4 Goal Setting Theory

Goal-setting theory refers to the effects of setting goals on subsequent performance. In 1960’s, Edwin Locke put forward the Goal-setting theory. This theory states that goal setting is essentially linked to task performance (Tosi, Locke & Latham, 1991). It states that specific and challenging goals along with
appropriate feedback contribute better task performance.

Edwin Locke found that specific, difficult goals are performed better than general and easy goals (Dela & Bernardo, 2013). Locke and Latham (2002) proposed that people are motivated to work when they have a goal. Goal-setting theory is widely utilized in the construction industry because productivity per day of any trade is based on a certain output of work (Latham & Baldes, 1981).

For example, masons/ block layers need to lay a certain number of blocks to account for the day’s work and pay. This is related to the concept of goal-setting theory which presupposes that an individual is committed to the goal. Locke and Latham (2002) explain that goal-setting focuses behavior and motivates employees. The assumption under this theory is that the worker’s perception of the value of the incentives accorded to them will be important in improving the work performance and in effect determine the implementation of megaprojects.

### 2.2 Conceptual Framework

Conceptual framework is a hypothesized model identifying the concepts under the study and their relationships (Mishra & Min, 2010). It is a diagrammatic presentation showing the relationship between the independent and dependent variables. It explains the relationship between the independent variables and the dependent variable.

---

**Building Information Modelling (BIM)**
- Autodesk Revit
- Graphisoft Archicad
- Tekla Structures
- Bentley Systems

**Top Management Support**
- Training
- Infrastructure
- Working Conditions
- Remuneration

**Stakeholder participation**
- Project Financiers
- Project team
- Government of Kenya
- The Kenyan citizens

**Project team competency**
- Experience
- Skills
- Leadership
- Qualification

---

**Effective Implementation of megaproject**
- Budget Compliance
- Schedule Compliance
- Quality Adherence
- Scope Compliance

---

**Figure 2.1: Conceptual Framework**

---

### 2.3 Empirical Review

This section reviews the empirical literature relevant to the study.

#### 2.3.1 BIM and effective implementation of megaprojects

Bynum, Issa and Olbina (2012) established that use of building information modeling has provided a means to increase the total project quality. The study explain that BIM provides accurate scheduling timetables, yields quantity take-offs and diminishes total project costs. The study intended to evaluate the current trends in BIM usage within the architecture, engineering and construction (AEC) industry in its support for sustainable design and construction. A survey was developed based on the existing literature reviewed. Analysis was performed on the participants’ responses to gain insight on the
AEC perspective of the use of BIM and sustainability within the AEC industry. The study established that the AEC industry is utilizing BIM in some form due to BIM’s ability to support collaborative and distributed work processes to support project delivery.

Arayici (2008) sought to review the state-of-art techniques and approaches for modelling of existing structures such as 3-dimensional laser scanner. A case study was conducted to demonstrate how to produce 3-dimensional CAD models of existing structures using a semi-automated technique. Demian and Walters (2014) conducted a case study to establish the effectiveness of BIM as a medium for communicating information within a construction team. The study was conducted on an off-site precast concrete fabrication facility. The facility was supplying precast units for four public sector projects using four information management systems: email, a construction project extranet tool, an enterprise Resource Planning system and a new BIM-based system. The study measured and visualized the flow of information through the four media as the projects progressed. The quantitative measurement of information flow was combined with qualitative data from interviews with the facility staff.

The study found that the introduction of BIM-based system diverted information flow through the building model and away from the extranet system. The use of email was not affected with the BIM-based system. The study established that BIM allowed considerably more accurate, on-time and appropriate exchange of information. The study concluded that it was possible to quantify some benefits of BIM to information management. Steel, Drogemuller and Toth (2012) sought to establish the model operability in BIM since the models are large and complex while the industry is one in which collaboration is a vital part of business.

The study established that AEC experts exchanged much information through BIM technology. Azhar (2011) sought to establish the trends, benefits, risks and challenges of BIM for the AEC industry. The study established that BIM helped architects, engineers and constructors to visualize what is to be built in a simulated environment to identify any potential design, construction or operational issues. The study further established that BIM encourages integration of roles of all stakeholders on a project.

The study found that 82 per cent of the BIM users believed that BIM had a very positive impact on their company’s productivity. According to Azhar (2011), 79 per cent of BIM users indicated that the use of BIM improved project outcomes such as fewer requests for information (RFIs) and decreased field coordination problems. Another 62 per cent of BIM users surveyed believed that use of BIM increased their chances of winning projects. 62 per cent of BIM users surveyed indicated that they planned to use BIM on more than 30 per cent of their projects in 2009.

Research predicts that prefabrication capabilities of BIM would be widely used to reduce project costs and improve the quality of work output in place (Sabol, 2008). A study sought to analyze and compare data from surveys conducted in the year 2006 and 2007 on the use of Virtual Design and Construction (VDC) and BIM technologies (Gilligan & Kunz, 2007). The study surveyed 171 respondents to represent a broad mix of geographic locations, business sizes, technical disciplines and project types. The study suggested that VDC use is significant, is expanding quickly and has entered a mainstream use. The respondents indicated that BIM is being used in more sophisticated operations and has improved participant engagement, reduced project risks, improved latency, cost and schedule performance.

2.3.2 Top Management Support and effective implementation of megaprojects

Cornelissen and Swart (2006) opined that sport megaprojects were generally initiated and driven by cadres of societal or corporate elites and were aimed at satisfying development goals or ambitions around projection, competitiveness or growth targets. Koh and Boo (2001) conducted a survey of 237 managers in Singapore to determine three measures of organizational ethics: top management support for ethical behavior, the organization’s ethical climate and the association between ethical behavior and career success.

The study established that organizational leaders can favorably influence organizational outcomes by engaging in, supporting and rewarding ethical behavior. Young and Jordan (2008) sought to establish whether top management support is a mantra or a necessity for project success. The research used a multiple-case study design to survey five cases with 59 interviews in total. Interviewees included project sponsors, top managers, members of the project team and stakeholders from multiple levels within the organization. The elapsed time between the first case study and the last case study was two years and seven months. The study established that top management support is the most important critical success factor for project success.

Zwikael (2008) sought to establish the top management support processes that have the greatest impact on software development project success and to compare the critical processes with the actual type of support provided by organizations. 17 top management support processes were identified by the study from the literature reviewed. Data was
collected from 213 software development project managers and their supervisors in Japan, Israel and New Zealand. For every country, the impact of top management support processes on project success was analyzed to identify critical processes. The actual level of use of both the critical and non-critical top management processes by senior managers was compared. The study established that the critical top management processes which have higher impact on project success often do not receive an appropriate level of attention from senior managers in the software industry. The study recommended that senior managers in the software industry focus on critical top management support processes, rather than paying lip service to less important ones. Zwikael (2008) identified the critical top management support processes to include identification of an appropriate project manager who can deal with people, create and sustain relationships and organize the project. The study recommended that the communication between the project manager and the organization follow a communication plan with all the stakeholder information requirements. The study recommended that a project success measurement criteria be established with specific milestones. The study recommended that line managers be involved in projects during planning. The study further recommended that an organization implement a project management software package that supports multi-project management. The study also recommended the use of a standard project management software, training project managers on how to use the software and the involvement of the project management office in supporting the project managers to use the software (Zwikael, 2008). 

Euripides (2014) sought to determine a radically renewed project risk management process in the United States of America. The study established that the benefits of risk management are not confined to large or risky projects. The study recommended that risk management be applied at all stages in the project cycle, from the earliest assessments of strategy to the supply, operation, maintenance and disposal of individual items, facilities or assets. The study established that risk management provides benefits in better accountability and justification of project decisions. The study further concluded that project risk management provides a consistent and robust process that supports decision-making.

2.4.3 Stakeholder Participation and effective implementation of megaprojects

Luyet, Schlaepfer, Parlange and Buttler (2012) sought to develop a framework to implement stakeholder participation in environmental projects. The study established a state-of-the-art overview of methods. The study proposed a comprehensive framework to implement stakeholder participation in environmental projects from stakeholder identification to evaluation. Megaprojects have several stakeholders.

Pinheiro (2015) conducted a study to identify project stakeholders. The study established that although there are several problems concerning internal stakeholders according to various studies, attention must be paid particularly to external stakeholders. The study lays much emphasis to the role of the public that forms a dynamic social network around the project. Brabham (2009) established that megaprojects seldom involve only one sponsor and managing body at the core, but rather coalitions and alliances of various delivering groups. Brabham (2009) also sought to explore the challenges of public participation in urban planning projects in the harnessing of creative solutions. The study established that crowd-sourcing model, a successful, web-based, distributed problem solving and production model for business is an appropriate model for enabling citizen participation process in public planning projects.

Aside from all internal stakeholders aiming towards delivering the project, each actor or group has its own objectives (Sallinen, Ahola, & Ruuska, 2011). Study has shown that solving conflicting resource scheduling is often the main task for management within the project (Sun & Zhang, 2011). Keeping partners and their responsibilities legally separate can be a complex task adding to uncertainty (Van Marrewijk, 2007). Although senior project managers may have strategic influence in such projects Eweje, Turner and Müller (2012) observe that the complexity of internal stakeholders and individual objectives cannot be underestimated. A study opines that considering the uncertainty of how internal stakeholders act, mega projects involve the greater society with people increasing awareness about such impacting undertakings (Li, Chen, & Wang, 2011). These stakeholder categories are the source of exogenous turbulence such as unforeseen events affecting the project from the outside (Missionier, & Loufrani-Fedida, 2014). The impact that mega projects have on the external environment creates demands of the stakeholders such as land acquisition, remaking zoning plans and having local politicians to support the project (Giezen, 2012).

Boon, Bawole and Ahenkan (2013) examined stakeholder participation in community development projects by analyzing the quadripartite model of the International Centre for Enterprise and Sustainable Development (ICED) in Ghana. The study established that the increasing importance of
stakeholders in project design, implementation, and evaluation requires mechanisms to ensure their effective participation to enhance project success.

2.3.4 Project Team Competency and effective implementation of megaprojects

A project’s success is, in part, contingent on effectively managing the constraints of time, costs and performance. It is essential for the project manager to possess and display appropriate competencies. Previous management studies have investigated the impact of competency on performance. Manaan, Ahadzie, Panford, and Proverbs (2014) established a competency based performance model for construction project managers where managerial behavior input is appraised. The study established that nine performance indicators for project managers’ competency should be developed. The study established performance indicators to comprise leadership, decision-making, mutuality and approachability, honesty and integrity, communication, learning, understanding and application and self-efficacy.

The study also established other performance indicators to consist of maintenance of external relations. In the context of construction project management; it is assumed that if the project manager and the project team have all the required competence for the work then the project implementation will be successful. Arendse (2013) sought to gain understanding of the project management competencies needed for the successful implementation of South African Built Environment industry projects. This was due to the fact that South Africa is faced with the challenge of reducing the huge backlog of infrastructure delivery. The study investigated the project management competencies required to improve the performance of the industry in delivering the much-needed infrastructure in time. The study reviewed competencies that are instrumental to the effective implementation of project management techniques and examined the contributory issues of project management leadership and project success.

The findings established that in addition to the more commonly emphasized project administration expertise, such as setting and managing scope, timelines and budgets, a project manager must be competent in structuring the project task and clarifying scope. The study established that a project manager needs to communicate effectively, develop SMART project objectives, show consistency and plan the project economically (Arendse, 2013). A study by Edum-Fotwe and McCaffer (2000) established that project managers in today’s construction industry are faced with fundamental roles and functions that are shifting focus due to a changing project environment. The study opines that for project managers to maintain professional competency they have to rely on knowledge and skills acquired through training and experience. Edum-Fotwe and McCaffer (2000) established that the extent to which such training enables project managers to effectively adapt to changing demands.

The study explains that competent project managers have considerable relevance for the training of future managers and also the kind of management and general manpower development policies that construction organizations can adopt. The paper established the changing role of project managers and how project managers are required to perform duties outside the traditional scope of project management. The study established that project managers need to be competent in technical skills, managerial skills, financial skills, information technology skills, legal skills, communication skills and general skills like sale, marketing and public relations to manage projects effectively. Patanakul and Milosevic (2008) proposed a list of competencies that multiple-project managers should possess in a competency model for effectiveness in managing multiple projects. The study established competencies that are unique to multiple-project managers to consist of organizational experience, interdependency management, multitasking, simultaneous team management and management of interproject process.

2.4 Critique of existing literature


Instead the studies focused on megaprojects such as the 2010 football World Cup in South Africa, Waterfront development in Toronto Canada, megaprojects in New York, London and Amsterdam and Suez Canal of Egypt. Other megaproject considered as cases were the Scottish parliament building, Sydney Opera House in Australia, Montreal
Summer Olympics, Bank of Norway headquarters, Denver international airport, Bankok metro and other megaprojects across the world. Literature review indicates that the studies focused on identifying the human factors that affect the effective implementation of megaprojects like project managers, architects and employees. The studies do not show which factors influence the effective implementation of megaprojects in Kenya since megaprojects have not been installed in Kenya for a very long duration of time. Jørgensen and Klotz (2015) sought to examine human resource allocation practices in multi-project organizations. The study has greatly influenced the research topic of this study. However, the study was conducted in the Scandinavian country of Norway while the current study seeks a Kenyan perspective. The study also focused on human resource allocation only while this study generalizes the resources required in the effective implementation of megaprojects in Kenya. In reviewing the risk management variable, Euripides (2014) studied troubled projects in constructions due to inadequate risk management and presented many benefits related to risk management. However, the study was carried out in the USA while the current study seeks a Kenyan perspective. In reviewing stakeholder participation, the study by Boon, Bawole and Ahenkan (2013) examined stakeholder participation in community development projects in Ghana. The study focused on analyzing the quadripartite model of the International Centre for Enterprise and Sustainable Development (ICED). This research study seeks to examine the factors influencing effective implementation of megaprojects in Kenya. Arendse (2013) sought to gain understanding of the project management competencies needed for the successful implementation of South African Built Environment industry projects. The study has enriched this study by guiding the researcher in what to expect in the findings. However, the study was conducted due to the fact that South Africa is faced with the challenge of reducing the huge backlog of infrastructure delivery. This study seeks to examine the factors influencing effective implementation of mega projects in Kenya.

2.5 Research Gap

Research has been done on the implementation of megaprojects across the world but very little research has been done to determine the factors influencing the effective implementation of megaprojects in Kenya. Zayed, Amer and Pan (2008) sought to identify the sources of project risks for highway projects, design an assessment model for the effect of the sources of risk using analytic hierarchy process (AHP) and test the designated model. The study established that implementing a railway project is fraught with higher levels of risks and greater uncertainties. Study has shown that projects related to the development of infrastructure sector are of more importance for developing countries than for developing nations (Ghoddousi & Hosseini, 2012). Causes for project success and failure have been the focus of numerous research studies, there has been no consensus on the issue. Delay in the implementation of infrastructural projects is a global phenomenon but is more common in developing countries than in developed countries. Okeyo, Rambo and Odundo (2015) conducted a case study on Sondu-Miriu Hydropower Project in Kisumu County to examine the effects of delayed payment to contractors on the implementation of infrastructural projects. The study found that in developing countries, delays in the implementation of infrastructural projects was more pronounced. Project delays have been reported in Malaysia, Indonesia, Qatar, Jordan, Egypt, Ghana, South Africa, and Kenya, among other countries (Okeyo, Rambo & Odundo, 2015). Flyvbjerg (2014) sought to take stock of megaproject management as an emerging and very costly field of study. The study established that the management of megaprojects is not conventional but an area of reform. The study found that several megaprojects had a calamitous history of cost overrun and therefore solution needed to be sought to save the resource wastage. This study sought to determine the factors influencing the effective implementation megaprojects in Kenya. The study was a case of the KShs 327 billion Standard Gauge Railway megaproject.

3.0 Methodology

Kothari (2004) defines research design as the arrangement of the conditions for collection and analysis of data in a manner that aims to combine relevance to the research with economy in procedure. The research design explains how data was collected to investigate the research questions. Mugenda and Mugenda (2008) explain that research design assists the researcher to establish the relationship between the dependent and independent variables of the study. Descriptive study was used to obtain information concerning current status of the phenomenon. The study described the empirical status of the variables at the SGR project construction sites from Mombasa to Nairobi (Kogi, 2013). A descriptive study was used to minimize bias and optimize on the reliability of data.

3.1 Population of the Study

A population is a complete set of individuals with same observable characteristics (Mugenda & Mugenda, 2008). The population for this study was
all the 1644 China Road and Bridge experts directly engaged in managing the implementation of the SGR project at various sites in the year 2016/2017. The experts are known to have a great understanding of SGR project.

### Table 3.1: Target population

<table>
<thead>
<tr>
<th>Target Population</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chinese expert managers</td>
<td>852</td>
<td>51.82%</td>
</tr>
<tr>
<td>Kenyan expert managers</td>
<td>792</td>
<td>48.18%</td>
</tr>
<tr>
<td>Total</td>
<td>1,644</td>
<td>100%</td>
</tr>
</tbody>
</table>

The experts consisted of 852 Chinese managers and 792 Kenyan managers that were supervising various sections of the SGR project from Mombasa to Nairobi.

### 3.2 Sample and Sampling technique

According to Kothari (2004), a sample is a smaller group obtained from the accessible population. The sample represents the relevant characteristics of the target population. Mugenda and Mugenda (2008) describe a sampling design as the process of selecting a number of individuals for a study in a way that the objects represent the characteristics of the population. According to Mugenda and Mugenda (2008) the sample size for any meaningful study must be a sample of 10% to 30% of the target population for adequacy. 164 respondents were randomly selected for this study. This formed 10% of the target population of 1644 CRBC experts.

### 4.0 Findings and Discussion

The total number of questionnaires that were administered was 164. The total questionnaires were properly filled and returned were 150. This represented a response rate of 91.24% as shown on Table 4.1. According to Rubin and Babbie (2010), return rates of above 80% is excellent.

A response rate of 91.24% was therefore fully representative of the target population.

#### 4.1 Inferential Statistics

Inferential analysis was conducted to generate the regression and correlation results. Regression results included the model of fitness, analysis of the variance and regression coefficients.

### 4.1.1 Correlation Analysis

The correlation results showed that there exist moderate positive and statistically significant relationship between Building Information Modelling technology and Effective implementation of SGR project in Kenya \( (r=0.318, p=0.000) \). The study result supports the findings of Bynum, Issa and Olbina (2012) who established that the use of building information modelling has provided a means to increase the total project quality. The study result also confirms the findings of Azhar (2011) who established that BIM technology integrates the roles of project stakeholders hence improves effective project implementation.

The correlation matrix indicated that there exist a weak positive and statistically insignificant relationship between Top Management Support and Effective implementation of SGR project in Kenya \( (r=0.12, p=0.143) \). The study result contradicts the findings of Young and Jordan (2008) who established that top management support is the most important critical success factor for project success. The correlation matrix showed that there exist a moderate positive and statistically significant relationship between Stakeholder Participation and Effective implementation of SGR project in Kenya \( (r=0.433, p=0.000) \). This study result supports the findings of Boon, Bawole and Ahenkan (2013) who established that there is increasing importance of stakeholder participation in project design, implementation and evaluation mechanism to enhance project success.

The correlation matrix showed that there exist a weak positive and statistically significant relationship between Project Team Competency and Effective implementation of SGR project in Kenya \( (r=0.215, p=0.008) \). This study result supports the findings of Patanakul and Milosevic (2008) who established competencies for megaproject managers to consist of organizational experience, interdependency management, multi-tasking, simultaneous team management and interproject process management. Correlation results further established existence of a weak positive and statistically significant relationship between BIM technology and Top Management Support \( (r=0.162, p=0.047) \). Correlation matrix also showed that there exist a weak positive and statistically significant relationship between BIM technology and effective implementation of SGR project in Kenya \( (r=0.284, p=0.000) \). The correlation matrix showed that there is a weak negative and statistically insignificant relationship between BIM Technology and Project team competency \( (r=-0.038, p=0.644) \). The matrix showed that BIM technology and project team competency are not linearly related.
The correlation matrix showed that Top Management support has a weak positive and statistically insignificant relationship with Stakeholder Participation ($r=0.749$, $p=.000$). This study result supports the findings of Azhar (2011) who established that planning tools influence the success of building projects.

### 4.1.2 Regression Analysis

The results presented in Table 4.1 present the fitness of model used in explaining the study phenomena. BIM Technology, Top Management Support, Stakeholder Participation and Project Team Competency were found to be moderate variables in explaining Effective Implementation of SGR project in Kenya. The coefficient of determination ($R^2$) was established to be 26.2%. BIM Technology, Top Management Support, Stakeholder Participation and Project Team Competency about SGR project implementation explain 26.2% of Effective Implementation of SGR project in Kenya. The results show that the model applied to link the relationship of the variables was satisfactory.

#### Table 4.1: Model Summary

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>$R$</td>
<td>0.512</td>
</tr>
<tr>
<td>$R$ Square</td>
<td>0.262</td>
</tr>
<tr>
<td>Adjusted $R$ Square</td>
<td>0.241</td>
</tr>
</tbody>
</table>

Table 4.2 shows the results on the analysis of the variance (ANOVA). The results indicate that the overall model was statistically significant. The ANOVA table 4.2 indicates that the independent variables are good predictors of Effective Implementation of SGR project in Kenya. The $F$ statistic of 12.858 and the reported $p$ value of 0.000 that is less than the conventional probability of 0.05 significance level support the study. The $F_{calc} = 12.858 > F_{critical} = 2.424$ at $\alpha = 0.05$. The study result implies that BIM Technology, Top Management Support, Stakeholder Participation and Project Team Competency influence the Effective Implementation of SGR project in Kenya (Zwikael, 2008). This study results supports the findings of Gilligan and Kunz (2007) who established that BIM technology is being used in more sophisticated operations in the AEC industry and has improved stakeholder engagement, reduced project risks, improved latency and improved project cost and schedule performance.

#### Table 4.2: Analysis of Variance

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regresion</td>
<td>55.858</td>
<td>4</td>
<td>13.965</td>
<td>12.8</td>
<td>0</td>
</tr>
<tr>
<td>Residual</td>
<td>157.482</td>
<td>145</td>
<td>1.086</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>213.340</td>
<td>149</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Regression coefficients results in Table 4.3 show that there exist a positive and statistically significant relationship between BIM Technology and Effective Implementation of SGR project in Kenya with a beta coefficient of 0.226 and a $p$ value of 0.005. The study result supports the findings of Gilligan and Kunz (2007) who established that BIM technology is being used in more sophisticated operations in the AEC industry and has improved stakeholder engagement, reduced project risks, improved latency and improved project cost and schedule performance.

#### Table 4.3: Coefficients of Regression

<table>
<thead>
<tr>
<th>Variable</th>
<th>$B$</th>
<th>Std. Error</th>
<th>$t$</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Constant)</td>
<td>0.858</td>
<td>0.410</td>
<td>2.095</td>
<td>0.038</td>
</tr>
<tr>
<td>BIM Technology</td>
<td>0.226</td>
<td>0.079</td>
<td>2.851</td>
<td>0.05</td>
</tr>
<tr>
<td>Top Management</td>
<td>0.059</td>
<td>0.071</td>
<td>0.826</td>
<td>0.410</td>
</tr>
<tr>
<td>Support</td>
<td>0.071</td>
<td>0.067</td>
<td>1.086</td>
<td>0.304</td>
</tr>
<tr>
<td>Stakeholder</td>
<td>0.306</td>
<td>0.067</td>
<td>4.591</td>
<td>0.000</td>
</tr>
<tr>
<td>Participation</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project Team</td>
<td>0.173</td>
<td>0.075</td>
<td>2.304</td>
<td>0.023</td>
</tr>
<tr>
<td>Competency</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Regression coefficients results in Table 4.3 show that there exist a positive and statistically insignificant relationship between Top Management Support and Effective Implementation of SGR project in Kenya with a beta coefficient of 0.059 and a $p$ value of 0.410. The study result contradicts the findings of Koh and Boo (2001) who established that top managers could influence project outcome by engaging in, supporting and rewarding ethical behavior of the project team. Regression coefficients results in Table 4.3 show that there exist a positive and statistically significant relationship between Stakeholder Participation and Effective Implementation of SGR project in Kenya with a beta coefficient of 0.306 and a $p$ value of 0.000.

The study result supports the findings of Boon, Bawole and Ahenkan (2013) who established that stakeholder participation in projects enhances project
success. Regression coefficients results in Table 4.3 show that there exist a positive and statistically insignificant relationship between Project Team Competency and Effective Implementation of SGR project in Kenya with a beta coefficient of 0.173 and a p value of 0.023. The study result supports the findings of other authors. Arendse (2013) established that training of project managers enables them to attain requisite competencies to effectively manage projects to meet changing client needs.

The multiple linear regressions equation used in this model was:

\[
Y = 0.858 + 0.306X1 + 0.226X2 + 0.173X3 + 0.059X4 + 0.410
\]

Where: \( Y \) = Effective implementation of county construction projects.

In the model, \( \beta_0 = -0.291 \), is the constant term. The coefficients were calculated by SPSS version 22 and found to be: \( \beta_1 = 0.306, \beta_2 = 0.226, \beta_3 = 0.173 \) while \( \beta_4 = 0.059 \) and were used to measure the sensitivity of the dependent variable (Y) to unit change in the predictor variables X1, X2, X3 and X4. \( \epsilon \) was the error term and was found to be 0.410. The error term captured the unexplainable variations in the model (Miles, Huberman & Saldana, 2013).

5.0 Summary and Conclusion

Correlation results revealed that BIM technology had a moderate positive and statistically significant effect on Effective Implementation of SGR project in Kenya (r=0.318, p = 0.000). Regression results revealed that there exist a positive and statistically significant relationship between BIM Technology and Effective Implementation of SGR project in Kenya with a beta coefficient of 0.226 and a p value of 0.005. This implies that an increase in BIM Technology would result to increased Effective Implementation of SGR project in Kenya by 0.318 units. These results support the findings of Bynum, Issa and Olbina (2012) who established that the AEC industry is using some form of BIM technology due to BIM’s ability to support collaborative and distributed work processes to support project delivery.

Correlation results revealed that there exist a weak positive and statistically insignificant relationship between Top Management Support and Effective implementation of SGR project in Kenya (r=0.12, p=0.143). Regression results revealed that there exist a positive and statistically insignificant relationship between Top Management Support and Effective Implementation of SGR project in Kenya with a beta coefficient of 0.059 and a p value of 0.410. The study result contradicts the findings of Koh and Boo (2001) who established that top managers could influence project outcome by supporting the project team at various stages of the project. The study results implies that an increase in Top Management Support would not result to an increase in Effective Implementation of SGR project.

Correlation results revealed that there exist a moderate positive and statistically significant relationship between Stakeholder Participation and Effective implementation of SGR project in Kenya (r=0.433, p=0.000). Regression results revealed that there exist a positive and statistically significant relationship between Stakeholder Participation and Effective Implementation of SGR project in Kenya with a beta coefficient of 0.306 and a p value of 0.000. The study result supports the findings of Boon, Bawole and Ahenkan (2013) who established that stakeholder participation in project design, implementation and evaluation mechanism enhanced project success.

Correlation results revealed that there exist a weak positive and statistically significant relationship between Project Team Competency and Effective implementation of SGR project in Kenya (r=0.215, p=0.008). Regression results revealed that there exist a positive and statistically insignificant relationship between Project Team Competency and Effective Implementation of SGR project in Kenya with a beta coefficient of 0.173 and a p value of 0.023. The study result supports the findings of Patanakul and Milosevic (2008) who established that organizational experience, interdependency management, multitasking, simultaneous team management and interproject process management enhance effective project management.

5.1 Conclusion

The study concluded that BIM Technology has an effect on the Effective implementation of SGR project in Kenya. The study concluded that Top Management support has no effect on the Effective implementation of SGR project in Kenya. The study concluded that Stakeholder Participation has an effect on the Effective implementation of SGR project in Kenya. The study also concluded that Project Team Competency has an effect on the Effective implementation of SGR project in Kenya.

5.2 Recommendations

The study findings revealed that BIM technology had a positive and statistically significant effect on Effective Implementation of SGR project. It is therefore recommended that BIM technology be adopted in all construction projects in Kenya. Study results revealed that Stakeholder Participation has a
positive and statistically significant effect on Effective Implementation of SGR project in Kenya.

It is recommended that stakeholder participation in projects be enhanced in all projects to ensure effective project implementation. The results of the study also revealed that Project Team Competency has a positive and statistically significant effect on Effective implementation of SGR project in Kenya. It is therefore recommended that project team competency be improved through training so as to implement megaprojects effectively.

References


Management and Economics, 32(12), 1153-1165.


[89] Sun, J. & Zhang, P. (2011). Owner organization factors and mitigating measures in p...


