SUSTAINABILITY OF CONTINUOUS IMPROVEMENT IN THE CONSTRUCTION SECTOR. A CASE OF OFFICE COMPLEX PROJECT IN THE TAMALE METROPOLIS

By

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A Thesis submitted to the Department of Construction Technology and Management, Kwame Nkrumah University of Science and Technology, Kumasi in partial fulfilment of the requirements for the award degree of

MASTER OF SCIENCE IN PROJECT MANAGEMENT

November, 2019

DECLARATION

I hereby declare that this submission is my own work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the award of any other degree or diploma at Kwame Nkrumah University of Science and Technology, Kumasi or any other educational institution, except where due acknowledgment is made in the thesis.

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ABSTRACT

Sustainability has become a wide-ranging term that can be applied to almost every facet of life on Earth, ranging from a local to a global scale and over various time periods. The existence of more than 70 different definitions for sustainability (Holmberg et al., 1992) highlighted its importance and illustrated the efforts made by different academic and practical disciplines to define and understand its implications to their fields. Continuous Improvement (CI) is a very critical tool in the construction industries today to enhance customer satisfaction, to become the cost leader and also to remain competitive in the global world today. The current study explored the sustainability of continuous improvement in the construction sector in the Tamale Metropolis. The study targeted thirty-nine (39) construction workers. The instrument for the data collection was developed by the researcher, preceded by a pilot study. The pilot study was initially conducted in similar construction industry with same project to ascertain its validity and reliability. The data for the study was basically from primary source in that closed-ended questionnaire was designed and distributed to stakeholders. Descriptive statistics was used to test the data. The study found that functional integration is one of the important components of sustainable continuous improvement. The study indicated that design for construction challenges is one major challenge on the project. More importantly, the study found that implementing standard operations, instructions and checklists and implementing continuous flow were the most significant mitigating strategies to the challenges of the project. The study recommended that project implementers Project implementers use Functional Integration as the main component in implementing sustainable continuous improvement by designing the project around processes, product and customers and also having Multifunctional teams to optimise processes and value streams to deliver product. Further, the study recommended strongly that Constructors especially, workers on the Office Complex Project have formal analysis of the mitigating strategies to the challenges associated with continuous improvement.

Keywords: Sustainability, Continuous Improvement and Construction Sector.

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ACKNOWLEDGEMENT

I am most thankful to God Almighty who by His grace, direction, protection and wisdom granted me the chance to carry out this research work. For all these, I say thank you, Father! This is how far you have brought me.

With sincere appreciation, I also acknowledge the immense commitment and contributions of Prof Joshua Ayarkwa of Department of Construction Technology and Management, KNUST, who supervised this research work and put forward his untiring efforts in ensuring that it comes to an acceptable standard. His recommendation, advice and constructive criticisms were extremely useful. Indeed, I am profoundly indebted to him for his supervision.

My profound gratitude likewise goes to my parents and all friends who encouraged me to pursue the programme. Without their participation and support, this work would not have come this far. To every one of you, I say Ayekoo!

DEDICATION

I dedicate this research work to my Family especially my Father and elder brother for believing in me.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

In terms of its activities and outputs, continuous improvement represents an integral part of the social development and economic growth of both developed and developing countries (Field and Ofori, 1988; Mthalane et al., 2007). Socially, it aims to fulfil community needs through providing users with facilities for housing, education, culture, medication, business, leisure and entertainment. In addition, it constructs infrastructure projects comprising roads, water and electricity stations as well as telecommunication networks to enable these projects to perform their intended functions effectively (Friends of the Earth, 1995). Economically, Lowe (2003) stated that the value-added by construction to the country's Gross Domestic Product (GDP) is in the range of 7% to 10% for highly developed economies and around 3% to 6% for underdeveloped economies. The construction outputs can be classified as a major component of investment and part of fixed capital; both are essential factors for a continuous economic growth (Field and Ofori, 1988; Mthalane et al., 2007).

Again, governments frequently use the Continuous Improvement (CI) as a driver to manage the local/national economy through increasing public expenditure to overcome the impact of recession and decrease the ratio of unemployment (Ball and Wood, 1995). On the other hand, the (CI) is criticised for having negative impacts on the environment. It is a very large consumer of non-renewable resources, a substantial source of waste and pollution to air and water. According to a study conducted by the U.S. Energy Information Administration (EIA) in 2011, the building sector consumes nearly half (48.7%) of all energy produced in the United States.

Furthermore, continuous improvement is responsible for generating most of the CO2 emissions worldwide. The increasing concerns towards saving the environment, minimizing waste and using natural resources efficiently called for the (CI) to be more sustainable. Great improvements have been observed in manufacturing, especially lean automobile industry which uses about 50% of manufacturing space, human effort in factories, product development time and investments in tools (Koskela, 2004). These improvements were the result of the development and implementation of a new production philosophy called “Lean Production”. This philosophy aims to avoid waste of time, money, equipment, effort and improving value through employing and combining existing approaches such as Just in Time (JIT), Total Quality Management (TQM), time-based competition and concurrent engineering (Melles et al., 1993). Adopting the “Lean Production” philosophy is expected to bring a revolutionary change to the way of work in every industry. In construction, lean production has been adopted relatively quickly by contracting companies which are keen to reduce waste in their construction projects. Even if only a small fraction of the gains observed in manufacturing were realised in construction, the incentive to apply these concepts would be tremendous (Emmitt et al., 2004). Hence, this paper aims to investigate the role of (LPs) as an innovative approach for achieving sustainability in the (ECI).

Sustainability, in a broad sense, is the capacity to endure. All the needs of current and future generations for survival and well-being depend largely on the natural environment, either in a direct or an indirect way. Sustainability aims to create and maintain the environmental, social and economic conditions that allow humans to exist with nature in "productive harmony" in the present and the future (USEPA, 2009). Sustainability has become a wide-ranging term that can be applied to almost every facet of life on Earth, ranging from a local to a global scale and over various time periods. The existence of more than 70 different definitions for sustainability (Holmberg et al., 1992) highlighted its importance and illustrated the efforts made by different academic and practical disciplines to define and understand its implications to their fields. However, all definitions agree that it is of prime importance to consider the future of the planet and develop innovative ways to protect and enhance the Earth while satisfying various stakeholders' needs (Boyko et al., 2006). Scientific evidence showed that humanity is living unsustainably. This is obvious in the form of using non-renewable resources, land dereliction, waste generation, water contamination, energy consumption, to name a few (Othman, 2010). Returning human use of natural resources to within sustainable limits will require a major collective effort. Since the 1980s, sustainability has implied the integration of environmental, social and economic spheres to meet the needs of the present without compromising the ability of future generations to meet their own needs (World Commission on Environment and Development, 1987).

Continuous Improvement (CI) is a very critical tool in the construction industries today to enhance customer satisfaction, to become the cost leader and also to remain competitive in the global world today. Companies such as Seagate, Agilent, Motorola and so on employed Six Sigma as the CI tool to improve product quality and also ensure customer satisfaction in their products and services. The reliability, timeliness, accuracy and perceived value of the products or services have become the keys to organizational success. The business environment has become turbulent, complex and even chaotic. At the same time business processes have evolved toward non-routine operations making project type working increasingly common in every business (Haikonen et al., 2004). To meet these challenges organizations, concentrate on their core competencies, outsourcing of less strategic activities, developing partnerships and building networks essential to sustain business growth and success. Continuous Improvement is defined as a collection of activities that constitute a process intended to achieve performance improvement. In manufacturing, these activities primarily involve simplification of production processes, chiefly through the elimination of waste. In service industries and the public sector, the focus is on simplification and improved customer service through greater empowerment of individual employees and correspondingly less bureaucracy. Strategic change can also be viewed as a process of logical incrementalism (Terziovski, 2002).

1.2 Problem Statement

The concept of Sustainable Development has occurred as an initiative to improve social, economic and environmental conditions. According to Brundtland Commission (1987), Sustainable Development is defined as "*development that meets the needs and aspirations of the present without compromising the ability of future generations to meet their own needs*" (Kates et al. 2005).

This notwithstanding, Laedre et al. (2015) described three different levels of sustainability in projects: strategic, tactical and operational. Green Building or Sustainable Construction does often have an extra cost of design and planning compared to traditional buildings (Lapinski et al. 2006). In addition, a lot of green projects were loaded with rework, delays, changes and overproduction due to bad selection of delivery methods. Waste in the process can limit both the building's and the project's sustainability (Klotz et al. 2007). By identifying waste, sustainable results can be improved by using delivery methods better suited to maximize value, such as Lean Construction. This implies the importance of sustainability in the production process, not just of the building itself.

Studies done by Huovila et al., (1998) investigated the fundamental connections of sustainable continuous improvement in the construction industry using the concept of lean construction. They argued from their findings that eliminating waste and adding value to the customer are the two most important contributions from lean to sustainability and that eliminating waste and adding value contribute to sustainability by minimizing resource depletion and pollution. Accordingly, Carneiro et al. (2012) and Valente et al. (2013) argue that reducing waste and increasing value primarily ensures environmental sustainability of projects.

In spite of these findings, United Nations Environment Programme (2009) has contended that the construction sector uses 40% of the global energy and contributes to approximately 30% of the global annual greenhouse gas emissions and therefore has great responsibility and capacity to improve. In consequence of this, Langlo et al. (2013) posit that the construction industry has experienced a relative decline in productivity compared to other industries.

In this regard, sustainability has become an important term in the construction industry, often referred to as sustainable construction or green building and that the construction industry is in need of better resource efficiency, better productivity, less waste and increased value (Langlo et al., 2013). This research thus contributes to literature by identifying the factors that influence Sustainable Continuous Improvement in the Construction Sector in Ghana.

1.3 Research Aim

The **aim** of the study is to assess the sustainability of continuous improvements in the construction sector.

1.4 Research Objectives

1. To identify the components of sustainable continuous improvement of the office complex project in Tamale.
2. To identify the challenges of sustainable continuous improvement of the office complex project in Tamale.
3. To suggest ways of mitigating the challenges of sustainable continuous improvement of the office complex project in Tamale.

1.5 Research Questions

The study sought to answer the following questions:

1. What are the components of sustainable continuous improvement of the office complex project in Tamale?
2. What are the challenges of sustainable continuous improvement of the office complex project in Tamale?
3. What are the ways of mitigating the challenges of the office complex project in Tamale?

1.6 Summary of Research Methodology

Research methodology is considered as the general approach to the design process of a study from the theoretical foundation to the collection of data and its subsequent examination (Thurairajah et al., 2006). That is, it provides theoretical and philosophical assumptions of the study and its consequence on the method or methods adopted for the study (Saunders et al., 2009). The large amounts of numeric data used to generalize findings and independent nature of the researcher, it implicated a positivist research philosophy (Kaboub, 2008). The researcher adopted a quantitative approach to understanding the association between the variable in this study. Furthermore, a deductive approach is best suited to establish the underlining relationship between variables. The study adopted a descriptive survey to avoid manipulation of variables in the study (Aliyu et al., 2014). The objective populace for the study were the workers on the office complex project in Tamale Metropolis. In effects, a survey approach and consequently a census sampling approach was used. According to this approach, people or gatherings of people that are capable and all around versed in data with a wonder of intrigue (Cresswell et al., 2011). The study made use of primary data collected using a data collection tool as part of the research design. To obtain data, an introductory letter to help elicit response (Chan et al., 2017) together with the data collection questionnaire was distributed to the target's respondents. All ethical considerations were made during the collection of data. Prior to the data analysis, the data was screened and coded using SPSS statistical software. Also, test for validity and reliability were carried out to ensure content and instrument validity of data (Creswell, 1994). For the data analysis, descriptive statistics and was used. The descriptive analysis included means, frequencies and standard deviations as well as mean score ranking.

1.7 Significance of Study

Taking into consideration the literature dearth on sustainability of continuous improvement in the construction sector, the outcome of the research will serve as useful literature for other researchers who want to work in this field of study. The study will highlight new knowledge areas in sustainability and continuous improvement and how these influence quality of construction works in Ghana. Furthermore, the findings from this work will enable construction sector companies to know the importance of sustainability of continuous improvement. Public and private construction firms will also benefit from this research work making them aware of the issues in sustainability of continuous improvement and how it closely linked to quality of construction works. Most important, the study will serve as an important guide, source of knowledge and reference work for academicians, construction managers, engineers, project managers, the general public, students and development partners. On the whole, the study offers both managerial and theoretical understanding of the value of sustainability of continuous improvement in the construction firms.

1.8 Scope of Study

This study focuses on the construction sector in Ghana. Given that the construction sector in developing-economy markets is noted for their contribution to development and GDP, and in view of the argument that the construction sector performance in many developing-economy markets like Ghana is poor in terms of services provided, this study concentrates on the sustainability of continuous improvement in the construction sector in Ghana. The scope is limited to the building construction project in Tamale because it will be too broad to use overall construction projects. Again, the research will be limited to Ghana and therefore the findings from the study will not be generalized to other construction projects outside Ghana.

1.9 Organisation of Study

The study is organized into the following chapters. The first chapter one outlines in the background to the study, problem statement, research questions, research objectives, summary of methodology, the significance of study, and scope of study. Chapter two talks about the literature. The chapter looks at the overview of sustainability of continuous improvement, key components of sustainability of continuous improvement, challenges of sustainability of continuous improvement and suggested mitigation strategies. Again, the chapter discusses the theoretical and empirical reviews with a conceptual framework and research gap. Chapter three details the methodology of the study. Research design, target population, sample size, sampling technique, and data collection methods and validity and reliability of research instrument. Chapter four deals with the presentation and analysis of data and finally, chapter five contains summary of findings, conclusion and recommendations of the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The chapter looks at the overview of sustainable continuous improvement, key components of sustainable continuous improvement, challenges of sustainable continuous improvement and suggested mitigation strategies regarding the Tamale Office Complex Project. Again, the chapter discusses the theoretical and empirical reviews with a conceptual framework and research gap.

2.2 Conceptual Review

2.2.1 Sustainability of Continuous Improvement

Sustainability of Continuous Improvement or innovation efforts is critical in the success of a construction sector today (Chaharbagh et al., 1999). They further argued that having differentiation through solely product and price alone will not ensure sustainable competitive advantage. However, Escrig-Tena, (2004) posited that by incorporating sustainable innovation and creativity within the operation of the sector, the sector can sustain its competitive advantage and business. Again, Berger (1997) contended that sustainability considers the protection of the attributes and resources that allow an organization to outperform its rivals in the same industry or product market have to offer over some usually undefined period of time into the future for the organization to maintain its competitiveness. Following the argument by Berger (1997), Chaharbagh et al., (1999) posited that sustainability is being able to endure, defend bear, tolerate, live, support, pass, accept, justified, negotiate and penetrate. In support of the definition, (Escrig-Tena, 2004) also asserted that sustainability is all about durability, difficulty to imitate and lack of incentives or inertia by potential imitators.

Following Berger (1997), some core principles of CI can be distinguished by using the ideal characteristics of Imai’s kaizen (Imai, 1986). The first principle is process orientation. Before results can be improved, it is the central tenet of CI that processes must be improved. Good results will follow automatically when processes are both understood and controlled. The orientation is toward the activities and work methods and not toward the outcomes (Leede et al., 1999). The statement from Leede et al., (1999) is actually consistent with the behavioural norm theory which states the importance of individuals and groups using the organizational goals to focus and prioritize their improvement activities. Leede et al., (1999) further argued that controlled action is useful to the industry performance and therefore activities carried out as of the organizational goals which are on par with the overall organizational directives of future growth. Moreover, Kuei et al., (2003) contended that customer-cantered Six Sigma is a concept very relevant to strategic focus in sustaining CI effort in the construction industry and it is the beginning state of the overall transformation process. (Kuei et al., 2003) indicated that recent empirical studies on supply chain quality management practices in Taiwan and Hong Kong show that technical requirements for such an effort is the same irrespective of the environment and therefore paying special attention to operational processes and supplier participation programs are very critical to improving industry performance.

2.2.2 Development of Continuous Improvement

The continuous improvement development involves monitoring activities implemented to support continuous improvement and this includes the development of monitoring processes to make it more effective (Escrig-Tena, 2004). Again, he argued that continuous improvement activities are critical to ensure the success of organizations, hence having a good monitoring system of continuous improvement is equally important. Moreover, he posited that most effective means of improvement involves following a systematic procedure of planning, execution and evaluation. In order to accomplish this, it is essential to standardize the functioning of the processes, use different improvement tools, obtain indicators of performance and gather information through benchmarking and self-assessment (Escrig-Tena, 2004). As a recent methodology of process improvement, Six Sigma has permeated construction sector. It is worth exploring as, a method of continuous improvement capability development because it has the potential to reveal the kinds of learning mechanisms for which researchers currently tend to search (Haikonen et al., 2004). Six Sigma is a commonly used statistical improvement method in most of the construction industries today. Six Sigma consists of systematic methodology of how improvement activities can be carried out. Six Sigma methodologies comprise of five steps in its process improvement (Haikonen et al., 2004). The steps are defined as, measure, analyse, improve and control (DMAIC). DMAIC calls for the identification of specific customer or stakeholder needs. He further argued that measure represents the identification of measurable, meaningful indicators and operation planning or implementation on a smaller scale whereas analyse represents the evaluation and determination of the critical success factors of the products or processes and the most likely causes of defects. The improve stage will follow that represents the opportunities and actions for getting the product or process better and removing the causes of the defects. Last but not least the control represents the implementation on a full scale. These step-by-step processes can well be referred to as an operational cycle.

2.2.3 Continuous Improvement Integration

Regular evaluations are required to ensure that continuous improvement is integrated into the organization's culture. Continuous improvement must be incorporated as part of the daily task or responsibilities of all the employees (Haikonen et al., 2004) This includes changes in organization's structure, systems, procedure as well as the methods and mechanism that are used to develop continuous improvement support and strengthen each other (Bessant et al., 1997). Integration involves managing the organizational changes to make continuous improvement a common practice.

There are many methodologies available for continuous improvement such as Six Sigma, the concept construction and so on (De Jong et al., 2007). These methodologies provide the construction industry ways and tools to streamline the construction industry structure in terms of communication, motivation or employees and so on. Bae and Kim (2008) argued that the integration of changes must be managed appropriately to ensure that continuous improvement can be sustained for long term. Communication of changes in the sector and the purposes of such changes are important to ensure that employees know clearly the construction goals and align their process improvement to achieve the goals (Campos et al. 2012). By doing so, sustaining continuous improvement will become easier as the construction industry's functions are aligned to continuous improvement activities (De Jong et al., 2007). Any organization that tries to run its business without a quality system, such as ISO 9000, is failing to recognize the importance of quality as a driver to business viability, sustainability and prosperity. They further argue that quality registration will provide organizational value as well as a distinct marketing benefit, but customers also believe that past performance, price and delivery are more important. The motivating force for most is the demand from customers to obtain quality certification and the fear associated with losing business (Cox et al., 2003; Toor et al., 2010; and Ugwu et al. 2007).

2.2.4 Continuous Improvement Management

One way for organizations to become more innovative is to capitalize on their employees' ability to innovate (Martensen et al., 1999). They further argue that an organization that depends solely upon its blueprints of prescribed behaviour is a very fragile social system. Work has become more knowledge-based and less rigidly defined. (Terziovski, 2002). In this context, employees can help to improve business performance through their ability to generate ideas and use these as building blocks for new and better products, services and work processes (De Jong et al., 2007).

Managers play a major, integrative role in linking activities and ideas between the operational, administrative and business aspects of the construction work (Platje, 2008). The integrative role of managers are instrumental in shaping employees' attitudes and expectations about work. For example, the extent of managerial influence exists in structuring work performance through delegation of authority, participation and feedback, providing adequate rewards and working conditions (Brewer, 1996). Giving employees operational autonomy encouraged an innovative culture. In a study among the employees of the construction industry, Axtell et al., (2000) found a positive relationship between participation and employees' innovative behaviour, measured using self-ratings of employees' suggestions and implementation efforts.

2.2.5 Involvement/engagement

Involvement or engagement according to Bessant et al., (1997) is that employees in the entire organization are proactively involved in continuous improvement. Getting employees to be involved in continuous improvement involves the communication of the importance of continuous improvement and also establishing common goals shared by the employees. This is based on the assumption that no managerial employees can make important contributions when they have the necessary power and preparation (Escrig-Tena, 2004). It holds that work efficiency increases if workers are more motivated, take on responsibilities and are allowed to take the initiative. What is emphasized, then, is the need to get members of the project involved in continuous improvement. This entails promoting training, empowerment, teamwork or setting up channels of communication to obtain information and knowledge and make it known to people (Escrig-Tena, 2004). Employees can also invest considerable effort in developing, testing and commercialising an idea (De Jong et al., 2007). They further posit that empowerment is important in two respects. First, granting autonomy to employees over aspects of their proximal work environment is an important indicator of management's trust in their workforce, which is likely to lead to greater employee commitment to the organization's goals. Second, autonomy allows workers to use their knowledge and experience, thereby will increase the motivating potential of jobs and enhance work performance. A similar role is to be expected for the level of work demands in jobs (Kudlak, 2008). Impoverished work, involving low levels of demand with monotonous and trivial tasks, not only denies workers the opportunity to use their skills but also offers little by way of challenge (Jackson, 2003). Powerful engagement process can help employees to connect with the change, overcome resistance to change and build commitment must be implemented, improved and sustained until the benefits of the change have been realized and new behaviours are firmly embedded into the culture (Miller, 2004). Continuous improvement activities involve changes and powerful engagement by the improvement team members will ensure the effectiveness of the continuous improvement activities.

2.3 Theoretical Review

The study is guided by Lean Construction Theory

The theory of Lean Construction was developed in the early 1990s. The result was a set of conceptual foundations, fundamental principles, basic practices and a more or less common vocabulary. These developments challenged the foundations, principles and practices of traditional project management. The lack of a coherent underlying theory of traditional project management in three areas led to the current problems in the construction industry. Lean Construction is an innovation that was provoked by the inability of traditional practice to solve a set of common and repeating problems on projects. Lean Construction evolved and developed from Koskela's seminal work (Koskela's 1992).

2.4 Empirical Review

Laedre et al. (2015) described three different levels of sustainability in a project: strategic, tactical and operational. In this work, we have concentrated on the operational level, which is the level most compatible with lean construction. To ensure better sustainability in the construction industry there exists several tools and methods. One of them is BREEAM, which globally is one of the most used environmental certification systems. Green Building or Sustainable Construction does often have an extra cost of design and planning compared to traditional buildings (Lapinski et al. 2006).

In addition, a lot of green projects are loaded with rework, delays, changes and overproduction due to bad selection of delivery methods. Waste in the process can limit both the building's and the project's sustainability (Klotz et al. 2007). By identifying waste, sustainable results can be improved by using delivery methods better suited to maximize value, such as Lean Construction. This implies the importance of sustainability in the production process, not just of the building itself.

Campos et al. (2012) investigated the relationship between lean construction and the sustainable maturity of construction companies. They found that principles such as focus on high quality, reduction of waste, flow of information between workers and project managers and continuous improvement are shared between the two concepts. Another interesting point of note was that the two concepts have mutual influence on each other: lean makes projects more sustainable and sustainability is making projects leaner

Horman et al. (2006) have used a set of social, economic and environmental indicators to compare site-built versus prefabricated buildings. Examples of indicators used are quality, material waste and working conditions. They also use indicators considering other aspects of the life cycle of a building, for example material choices, maintenance costs and deconstruction. The literature review found other authors presenting sustainability indicators for the construction industry, such as Cox et al. (2003), Toor et al., (2010), Ugwu et al., (2007).

2.5 Components of Sustainability of Continuous Improvement

2.5.1 Build Understanding with a Prescriptive Content Framework

Critical requirement for a successful and sustainable continuous improvement is to seek first to build understanding, then to drive action. Employee empowerment lies at the intersection of capability and accountability (Escrig-Tena, 2004). Employees become capable of improving continuous improvement because industries invest in making them sufficiently capable to do so (Escrig-Tena, 2004). Many organizations put their continuous improvement approach into meaningful context. A great strategy for addressing the practical considerations is to develop a documented content model that breaks the continuous implementation into manageable stages and steps and explains those stages and steps in a meaningful way (Miller, 2004). Getting out of the offices and into the operation so you can have meaningful interactions with the work teams and make smarter decisions about how to operate (Escrig-Tena, 2004).

2.5.2 Engage the Organization with a Structured Deployment Approach

In fact, the primary objective for the initial deployment, particularly if sustainability is a focus area, should be employee engagement because sustainability is ultimately a function of engagement (Haikonen et al., 2004). Getting the managing process and governance model established is paramount.

1. Quick results are great, but not if they cause unnecessary disruption and angst among employees. In some situations, simply having clear line of sight into the short-term business benefit with a well-defined and realistic plan to capture it may be sufficient
2. Establishing a "guiding coalition" at the site is a must. Site leaders must feel like they have some control over the direction that continuous improvement takes at their location or they will not engage in a meaningful way.
3. Early investments to build capability and coach the process are crucial. Investments in capability building may create a longer runway to Return on Investment (ROI) than simply "getting something done," but the risk of regression is significantly lower

4. The first series of improvements must be a shared effort between the line organization and the continuous improvement organization. (Haikonen et al., 2004).

2.5.3 Drive Execution with a Well-Defined Managing Process

Managing process is a set of activities that need to happen at the site to ensure that continuous improvement is given appropriate focus and attention. The managing process is crucial to the success of the production system implementation. Without it, the organization risks that the sites will not autonomously continue the journey long past the initial deployment. Rituals and routines that need to be established as part of the overall site managing process include:

- Strategy development and execution management
- Improvement project identification, prioritization, and execution management
- Functioning of improvement teams
- Frequency and depth of performance opportunity assessment (i.e., a "gap to perfect" performance analysis)
- Frequency of re-assessment against the practice maturity model and updating of the implementation plan generated from the re-assessment
- Objective third-party milestone assessments (De Jong et al., 2007).

2.5.4 Hold People Accountable with a Sequential Governance Model

If the managing process refers to the activities to facilitate a production system journey at one site, then the governance model refers to the activities required to ensure that the project is managed across the business (Gomes et al., 2005). The challenge that many companies face is that they're standard governance model is solely focused on outcomes (that is operational performance measures) without an appropriate focus on the inputs to those outcomes (Gomes et al., 2005). The best governance model for a production system is not to create a whole series of new rituals and routines focused solely on continuous improvement but to embed continuous improvement into the standard governance model (Chaharbaghi et al., 1999). However, to do that well, the status of the construction system project needs to be articulated in the right way. Our experience was that construction managers need to be provided with “leading indicators” scorecard that quickly and concisely provides a snapshot of the following:

- Status of outstanding strategic objectives
- Breadth, depth, and health of the improvement project pipeline
- Operational maturity profile of the organization (that is what stage in the project)
- Value capture from CI
- Volume and status of all improvement activity (Boyko et al., 2006).

2.5.5 Functional Integration

One of the key principles of an integrative improvement approach is that the organisation should be designed around processes, products and customers (Kuei et al., 2003). Multifunctional teams optimise processes and value streams to deliver superior products to ‘delighted’ customers (Bessant et al., 1997). Again, they posit the system must drive this process-based approach and prevent possible sub optimisation of functional improvement approaches. This means that functional improvement requirements (quality, maintenance, demand and supply planning) and the various continuous improvement methodologies used are on the same platform and are executed simultaneously and in concert with one another (Hammond et al., 1996; Guide, 2000; Lundmark et al., 2009).

2.6 Challenges of Sustainability of Continuous Improvement

Many researchers agree that construction is complex and difficult to manage due to a high number of internal and external uncertainties (Hammond et al., 1996; Guide, 2000; Lundmark et al., 2009). Internal uncertainties typically originate from the construction firm's internal process challenges, while external uncertainties depend on the challenges outside the construction firm (Johnson, 2003). Based on the literature review, we developed a three-level model of construction challenges, industry level refers to the challenges related to a construction industry (economic, environmental and political perspectives); system-level refers to the construction system (closed product life-cycle system perspective); and process level refers to the construction process (the firm's operations perspective) (Axtell et al., 2000).

2.6.1 Industry-Level Challenges

On an industry level, the remanufacturing challenges are analysed from economic, environmental and political perspectives (Miller, 2004). The industry-level challenges can be classified as legislation and environmental regulation, customer preferences and technological change. According to Guidat et al. (2015), other researchers tend to generalize remanufacturing industry challenges into the following three categories: sceptical customer perception, variable inflow of cores (used and returned worn-out products or their parts), and labour costs versus product value (Perez-Araos et al., 2006).

2.6.2 System-Level Challenges

On a system level, the construction sectors challenges were analysed from the perspective of stakeholders in a closed product lifecycle system: product designers, manufacturers, buyers/users, service/maintenance, remanufacturers and recyclers. Challenges identified at this level often originate at or between different product life-cycle stakeholders, contributing to constructor complexity and uncertainty (Guidat et al., 2015),

2.6.3 Material Flow Challenges

The challenges in material flow are closely linked to the demand and supply challenges, with the main focus on construction facilities as a hybrid system for cost efficiency, especially related to inventory control and management (Lowe, 2003)

2.6.4 Information and Knowledge Challenges

Faced with negative consequences of insufficient product information sharing among the product life-cycle actors, construction firms fail to utilize their learning capacity; manage inventories; coordinate production, distribution and enterprise collaboration; and manage standard construction operations (Benavent et al., 2004). The possible introduction of agent-based systems for information sharing to facilitate learning and knowledge is not effective for decision making regarding returned products (O'Shannassy, 2008). Consequently, construction fails to overcome challenges in end-of-life processes, such as a construction system integration, data exchange and resource management (Zairi et al., 2000).

2.6.5 Design for Construction Challenges

Decisions made during the design phase have a considerable effect during the construction process. Indeed, even though product is greatly dependent on product design, design for construction is rarely applied in the product development process quality (Bicheno et al., 2009). Among the main reasons for this are unestablished routines and communication practices between multidisciplinary product development teams, and weak attempts to incorporate design for construction as well as design for product-service systems into the product development process (Chapman et al., 1997).

Moreover, product design typically fails to address sustainability initiatives through the maximization of environmental and economic impact savings across the product construction chain, or even the exploration of a range of product life-extension strategies and other eco-design methods quality (Bicheno et al., 2009).

2.6.6 Cost challenges

The costs associated with the remanufacturing process remain a great challenge to many remanufacturers (Perez-Araos et al., 2006). Cost fluctuations are closely related to uncertainty in the processes, and especially to acquired core condition (Reed et al., 2006). Therefore, it is important to control the performance of the process; however, key performance indicators (KPIs) are rarely used at the remanufacturing facilities (Jackson, 2003). The performance measurement system is typically undeveloped and fails to meet the required process conditions as well as business objectives quality (Bicheno et al., 2009).

2.7 Mitigating Strategies to the Challenges of Sustainable Continuous Improvement

2.7.1 Implementing Standard Operations, Instructions or/and Checklists

Implementing standard operations, instructions or/and checklists would develop a base for an MRP system at the construction facility. Standard operations provide constructors with a stable foundation to build further improvements to enhance construction quality (Bicheno et al., 2009). By communicating in the standard way, the challenges related to the core and spare part information flow can be diminished. Standard operating procedures can be expressed through instructions for the standard process steps or activities needed to complete a task; thereby reducing the deviation in task performance by firm's employees. These instructions can encompass both images and text descriptions, written briefly and simply to ensure better understanding by constructors and technical personnel (Sugimori et al., 1977). According to lean, the best standards are developed by the employees who are directly involved in performing the task. Through identifying the best practice, standard operations can be designed, tested, improved and applied to construction processes (Kanban, 2010). To follow standards in carrying out a given operation, a specific set of procedures has to be established. The checklist that is, a written list of activities or tasks to be performed and/or controlled in the standard sequence can ensure that the best performance is achieved. The introduction of the standard work procedures helps establish stable lead time that can be used to communicate internally and externally.

2.7.2 Implementing Continuous Flow

Implementing continuous flow would mostly affect the material movement at the construction facility; however, the information flow will be also changed dramatically. There are a broad variety of tools and practices to establish a continuous flow. The construction process challenges related to stochastic construction processes can be solved by continuous flow which requires great employee involvement in total construction system transformation. The continuous flow focuses on linking the separate construction steps in a smooth undisrupted chain, maintaining stable and predictable cycle times; this is currently absent at the four case companies. This system attempts to reduce the cost and time of information processing and benefits with improved productivity through reduced lead time, improved product quality and an optimized inventory level (Sugimori et al., 1977).

2.7.3 Employing the Kanban Ordering System

Employing the Kanban ordering system is possible means to control the construction process. Typically, Kanban refers to a system with triggering mechanisms to control process pace by sending a signal upstream that reflects actual customer demand. Respectively, the downstream process pulls products from upstream, creating a linked product flow. A great improvement resulting from the transformation of the ordering system to the Kanban is control of the inventory level at the construction site (Kanban, 2010).

2.7.4 Organizing Employee Cross-Training and Learning through Problem Solving

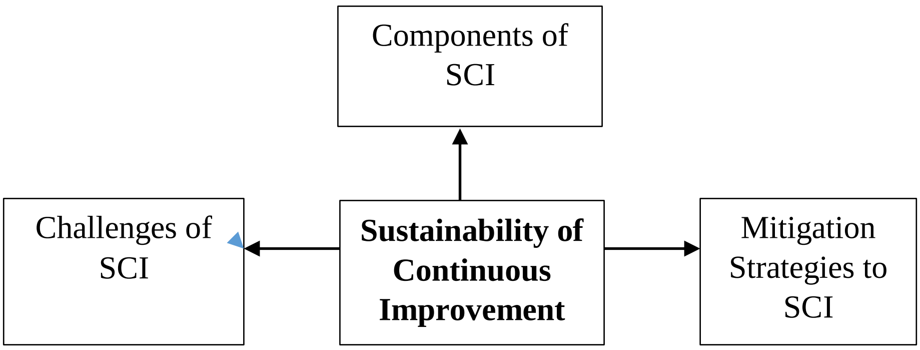
Organizing employee cross-training and learning through problem-solving is necessary due to construction firm's insufficient information sharing. Employee cross-training would benefit all case firms through investments in employee skills (Bouzon et al., 2012; The Productivity Development Team, 1999). Employee training is a dynamic, hands-on learning activity that involves knowledge sharing and teaching essential skills by the area expert or leader. It is an essential element of the continuous improvement philosophy that leads to the establishment and maintenance of standardized work tasks, the development of a platform for efficient and effective problem solving, the creation of a safe workplace, and the generation of partnering relations with contractors (Bicheno et al., 2009). Training in order to exchange experience, gain knowledge in the related area, or establish networking to generate the lacking data is vital for construction firms since construction firms are currently very dependent on manual work.

2.7.5 Designing Factory Layout for Continuous Flow

Designing factory layout for continuous flow is beneficial in terms of solving inventory management challenges and, together with the continuous flow and Kanban ordering system, has the greatest effect on the lead time reduction. Moreover, an appropriate layout design contributes to process improvements and workshop capacity utilization (Bouzon et al., 2012; The Productivity Development Team, 1999). By introducing a lean layout, construction firms are able to create a continuous material and information flow and improve the control of inventory. Furthermore, the mentioned layout improvements facilitate communication between employees working at the site (McLaughlin et al., 2013). Achieving a lean layout is a challenging but realistic task for construction firms working with product disassembly assembly tasks.

2.8 Conceptual Framework

The conceptual framework specifies the concepts that guide the study to achieve its objectives. It is developed from the theoretical and empirical review of literature. It touches on the indicators measuring each construct or variable



Author's Own Construction, 2019

2.9 Research Gap

Literature focus on specific sectors such as manufacturing firms, transportation firms, hospitals, information technology firms, and banking industries. However, the current literature search in the Ghanaian context revealed that the subject has received very little academic or scholarly attention. Indeed, to the best of the researcher's knowledge, much has been written about the importance of quality management and continuous improvement in the current literature, but what is not recognized is that it repeatedly fails to provide any solid foundation for sustainable success (Johnson, 2003). This research thus contributes to bridging the dearth in literature by exploring the effect of logistics service quality on customer satisfaction and firm performance in the pharmaceutical industries.

2.10 Chapter Summary

The chapter looked at the overview of sustainability of continuous improvement, key components of sustainability of continuous improvement, challenges of sustainability of continuous improvement and suggested mitigation strategies. Again, the chapter discussed the theoretical and empirical reviews with a conceptual framework and research gap.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The chapter conceptualises the methodology into the following areas: Research Approach, Research Strategy, Research Design, Target Population, Sample Size, Sampling Technique, and Data Collection Methods and Validity and Reliability and Instrument for Collecting Data.

3.2 Research Approach

There are two main research approaches, which are inductive and deductive. As per Trochim (2006), deductive thinking moves from the general to the particular in that contentions depend on standards, laws and are broadly acknowledged standards, while the inductive deals with the development of theories. The study investigates into the Office Complex Project in Tamale Metropolis Hence, this study adopted the deductive approach in order to establish the sustainability of continuous improvement in the construction sector.

3.3 Research Strategy

This research study used a questionnaire-based survey to facilitate the achievement of the main research objective. Two main characteristics describe the purposes of a survey. Firstly, surveys aim to produce some descriptions about the distribution of phenomena in a population (Ling et al., 2008). Therefore, a survey analysis may be concerned with comparing the relationship between variables, or with demonstrating the finding, descriptively (Zikmund et al., 2009). Secondly, surveys are used to collect information from research population through the use of structured questions. Additionally, a survey provides a means for collection of a large amount of data from a substantial population in a highly economical way and it also operates on a foundation of statistical sampling to protect a particular representative dataset (Liu, 2008).

3.4 Research Design

To Yin (2009), every empirical study form has an inherent if not overt research design. It is the connection of a study's empirical data to its initial research questions and ultimately, to its conclusions in a logical sequential manner (Baah-Ennumh, 2012). In addition, Yin (2009), points out that research design preponderantly constitutes the outline of the various stages involved in the research exercise and serves more or less as a plan that guides the investigator through the process of collecting, analysing and interpreting observations. Accordingly, the study employed case study research design. According to Anthony et al., (2009) case study research is an effective methodology to investigate and understand complex issues in real-world settings. Case study designs have been used across a number of disciplines and it is very pragmatic, flexible research approach, the variation in definition, application, validity, and purposefulness.

3.5 Study Population

Literally, this refers to the aggregate number of people found within a particular area. In other words, Saunders (2007), consider a population as the complete set of cases whether human beings or not from which a sample is selected or drawn. Likewise, population is also considered as a collection of items or individuals with one or more common characteristics from which data can be elicited and analysed (Kumar, 1996; 1999). Also, Ruben et al., (1989) defined study population as the sum of all elements from which the sample is actually selected. With regard to these, the study population consisted of all construction workers made of project team (7) and other personnel (32) on the Office Complex Project in Tamale Metropolis. Overall, the targeted population was thirty-nine (39) (Office Complex Project Document, 2019).

3.6 Sampling Procedures

3.6.1 Sampling Frame

Sample frame, according to Rubin et al., (1989), is the actual list of sampling units from which the sample is selected. The site managers and labourers on the Office Complex Project constituted the study's sampling frame. The population as shown for the study is thirty-nine (39) and is shown below:

Table 3.1: Type of respondents, population and sample size

Project Team	Total
Technical Director	1
Project Manager	1
Quantity Surveyor	1
Engineer	1

Site Supervisor	2
Accounts Officer	1
Total	**7**

Other Personnel	Total
Store Keeper	1
Mason	4
Carpenters	5
Steel Benders	4
Block Moulders	4
Mechanics	1
Operators	3
Drivers	3
Security	3
Labourers	5
Total	**32**

Source: Field Data, 2019

3.6.2 Sampling Size and Sampling Technique

The study employed census sampling strategy to retrieve data from the respondents because according to Israel (1992) when a population is less 200, the total population should be considered for the sample size. Hence, in this study, the sample size is equal to the population. In addition, Israel (1992) advice that in such cases census sampling technique should be adopted. Thus, this study again adopted the census sampling technique in the data collection. The census sampling technique was adopted in light of two reasons: first, simple choice and distinguishing proof of people or gatherings of people that are capable and all around vexed in data with a wonder of intrigue (Cresswell et al., 2011). Second, the significance of readiness and accessibility to take an interest, and the capacity to convey encounters and feelings in an expressive, intelligent and understandable way (Bernard, 2002; Spradley, 1979).

3.7 Unit of Analysis

The researcher edited the data collected from the field of study to ensure consistency in the responses. This was done to ascertain whether all questions on the key components of sustainability of continuous improvement, challenges of sustainability of continuous improvement and mitigation strategies were duly responded and contained accurate information to make meaning.

3.8 Data Collection and Analysis

The people's viewpoints were elicited by means of a survey instrument's designed questionnaire for the study in order to establish a profile of sustainability of continuous improvement. Basically, this involved the compilation of structured questions as a research instrument, with close-end multiple-choice questions grounded on the 5-point Likert-style rating scale which offers respondents a range of options or answers to choose from. Literally, 5 on the scale represent the highest score and 1 is the lowest on the scale. Respondents for the study had choices either to disagree or agree to an extent with the questions made within the scope to make data collation and analysis much simpler and ensuring that issues of concern are directly addressed by the selected answers. Also, necessary alterations and reforms to the questionnaire were made within the context of the study, and respondents were briefed about the significance of the research in order to make them truthful and diligent with their responses. Also, specific codes were assigned to all the questions in the questionnaire (close-ended) and computerized after an overview of the responses was done. Furthermore, the data processing aspect involved the explanation of variables, coding of data (keying) and finding missing values by editing. SPSS was used to analyse the data.

3.9 Ethical Consideration

The researcher bearing in mind the several implications associated with research ethics considered sending an official letter to the site managers. In addition, the various participants of the study were accorded the requisite reverence as the study in itself required the acquisition of certain personal information. Also, respondents were adequately educated on the plethora of reasons for the study such as the kind of information being elicited for, motives for eliciting the information, usage of generated information, study's direct and indirect effect on them through the data collected. Also, mechanisms were put in place to ensure anonymity and confidentiality of the participants at all time, and were, however, made to understand that they had the legitimacy to pull out of the study at any time as their participation was voluntary.

3.10 Chapter Summary

The chapter detailed the methodology of the study. Research design, target population, sample size, sample frame, sampling technique, and data collection and analysis, unit of analysis and ethical consideration.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter discusses the results and thorough discussion of responses gleaned from the respondents. The main sections of this chapter concentrate on overview of the study areas, questionnaire return rate, respondent profile, descriptive results, and chapter conclusion.

4.2 Questionnaire return rate

Thirty-nine (39) respondents were used. Out of these, thirty-five (35) were retrieved resulting in a response rate of 89.74%. This response rate, according to Mugenda et al., (2009) is good for analysis and again representative. In this regard, Mugenda et al., (2009) argued that response rates above 50% are suitable and adequate to carry out an investigation. They again posited that response rate of 60% is good and 70% response rate is excellent. Consequently, the response rate passed the inception of data analysis for this study.

4.3 Description of the Sample

Data on respondents' demographics were collected and analysed. Variables included were position, educational level, and construction project experience. These features were spotted to correctly situate the study into its proper view since they have a high tendency to update the researcher on respondents' characteristics in so far as this study is concerned. The following subsections give the results.

4.3.1 Distribution of Respondents by Position

Characteristically, Health and Safety officers constitute the majority 39.9% followed by Site Engineer represented by (29.7%). More importantly, the analysis indicated that apart from health and safety officers and site engineers, Site Foreman constituted 11.0%. Though the project would have expected project managers to be the highest, rather the Project managers represented only 10.2%. This presupposed that majority of the workers in so far as the Office Complex Project is concerned are health and safety officers.

Table 4.1: Distribution of Respondents by Position

Edu. Level	Frequency	Valid Percent
Operator	3	9.2
Project Mgt	5	10.2
Site Engineer	10	29.7
Site Foreman	6	11.0
H&S Officer	11	39.9

Total	35	100

Source: Field data, 2019

4.3.2 Distribution of Respondents by Education Level

Regarding the education level, it was indicated that those who hold BSc degree were the majority represented by (47.9%). This was followed by HND holders establishing 32.7%. Msc holders were few representing 10.2%. Those who hold PHD denoted only 9.2%. The analysis showed that the majority of workers on the Office Complex Project are BSc holders.

Table 4.2: Distribution of Respondents by Education Level

Edu. Level	Frequency	Valid Percent
PhD	3	9.2
MSc	5	10.2
BSc	15	47.9
HND	12	32.7
Total	**52**	**100**

Source: Field data, 2019

4.3.3 Distribution of Respondents by Construction Work Experience

Construction work experience is regarded to be one of the foremost characteristic in construction companies. On the basis of this, the analysis indicated that workers have experience and that those who have worked from 1-5yrs established the majority. This was represented by (39.9%). Apart from those who have 1-5years experience, workers who have 11-15years experience represented (29.7%). Further, workers who have 6-10years constituted (11.0%). Though experience matter in construction, those who have worked for 16-20years and over 20years constituted 10.2% and 9.2% respectively.

Specifically focusing on the Office Complex Project the analysis concluded that most of the workers had 1-5years experience.

Table 4.3: Distribution of Respondents by Construction Work Experience

Edu. Level	F r e q u e n c y	Valid Percent
Over 20yrs	3	9.2
16-20	5	10.2
11-15yrs	10	29.7
6-10yrs	6	11.0
Up to 5 yrs.	11	39.9
Total	**35**	**100**

Source: Field data, 2019

4.4 Descriptive Results

This section presents descriptive results on the study's constructs – that is management structures, project financial system and donor policies. Five different Likert scale were used that ranged from strongly agree (=1) to strongly disagree (=5). These were used to measure all items.

4.4.1 Components of Sustainability of Continuous Improvement

Fourteen (14) items were adopted from Escrig-Tena (2004) to measure the dimension of components of sustainability of continuous improvement. Each of these variables were measured either with two dimensions or three dimensions. Though the components for sustainable continuous improvement are not exhaustive, the ones relevant to the construction sector were adopted.

The variables – Building Understanding with a Perspective Content Framework, Engage the Organisation with a Structured Deployment Approach, Drive Execution with a Well-Defined Managing Process, Hold People Accountable with a Sequential Governance

Model and Functional Integration. Respectively, the study restated the dimensions of the components of sustainability of continuous improvement. The descriptive statistics of the items and their overall average score are shown in Tables 4.4.

With respect to Building Understanding with a Perspective Content Framework, there is employee empowerment that intersects capability and accountability was ranked to be the second-highest with mean and standard deviation values of 4.4 and 0.9911 respectively. Again, continuous improvement approach is put into meaningful context was ranked second to be the highest with the mean value of 4.5 and standard deviation of 0.8912. Moreover, there is a practical consideration to develop content model for continuous improvement was ranked third with a mean value of 4.3 and standard deviation of 0.8112. The analysis showed that continuous improvement approach as sustainable improvement is important in so far as the construction of the office complex project is concerned. Overall, building understanding with a perspective content Framework had a mean value of 4.4 and standard deviation of 0.9245 indicating that government plays a vital role in the mining sector activities.

Regarding Engage the Organization with a Structured Deployment Approach, respondents ranked employee engagement to be the highest with mean and standard deviation values of 4.5 and 0.9221 respectively. Further, management process and governance model are established was also ranked second with a mean value of 4.4 and standard deviation of 0.8991. Again, there is investment in capability building that creates return on investment was ranked third by respondents with mean value of 4.3 and standard deviation of 0.8212. Overall, Engage the Organization with a Structured Deployment Approach had a mean value of 4.3 and standard deviation of 0.8415 indicating that Engage the Organisation with a Structured Deployment Approach played a significant role in the construction of the office complex project.

With respect to Drive Execution with a Well-Defined Managing Process respondents ranked strategy development and execution management as the highest with a mean and standard deviation values of 4.4 and 0.8912 respectively. Again, improvement project identification, prioritisation and execution were ranked second with a mean value of 4.3 and standard deviation value of 0.7112 and lastly, frequency and depth of performance opportunity assessment were ranked third with the mean value of 4.2 and standard deviation of 0.7011. Overall, Drive Execution with a Well-Defined Managing Process had a mean value of 4.3 and standard deviation of 0.8245 indicating that it was a very significant component of the construction of project.

Again, Hold People Accountable with a Sequential Governance Model were measured by three dimensions. Status of outstanding strategic objectives, Volume and status of all improvement activities and Operational maturity profile of the organization. Respondents ranked Status of outstanding strategic objectives was ranked highest with mean and standard deviation values of 4.5 and 0.9954 and Volume and status of all improvement activities were ranked second with a mean value of 4.4 and standard deviation of 0.8644. The operational maturity profile of the organization with 4.3 and standard deviation of 0.8221. Overall, Hold People Accountable with a Sequential Governance Model had a mean value of 4.4 and standard deviation of 0.9299 indicating that Hold People Accountable with a Sequential Governance Model was very significant in the construction project.

Furthermore, Functional Integration was measured by two dimensions. The project is designed around processes, product and customers and multifunctional teams optimise processes and value streams to deliver the product. Interestingly, the project is designed around processes, product was first with the mean value of 4.5 and standard deviation of 0.9923. Again, multifunctional teams optimise processes and value streams to deliver product was also ranked second with mean and standard deviation values of 4.4 and 0.9113 respectively. The analysis showed that Functional Integration was very vital on the Construction of the Office Complex Project at Tamale. Overall, Functional Integration had a mean value of 4.5 and standard deviation of 0.9299 indicating that functional integration was significant.

Table: 4.4 Components of Sustainability of Continuous Improvement

Components of Sustainability of Continuous Improvement	*Mean*	*St Dev*	*Rank*	*Overall Ranking*
Building Understanding with a Perspective Content Framework	**4.4**	**0.9245**		**2nd**
There is employee empowerment that intersect capability and accountability	4.4	0.9911	2nd	
Continuous improvement approach is put into meaningful context	4.5	0.8912	1st	
There is a practical consideration to develop content model for continuous improvement	4.3	0.8112	3rd	
Engage the Organisation with a Structured Deployment Approach	**4.3**	**0.8415**		**5th**
The is employee engagement	4.5	0.9221	1st	
Management process and governance model is established	4.4	0.8991	2nd	
There is investment in capability building that create return on investment	4.3	0.8212	3rd	
Drive Execution with a Well-Defined Managing Process	**4.3**	**0.8245**		**4th**
There is strategy development and execution	4.4	0.8912	1st	

management				
Improvement project identification, prioritisation and execution	4.3	0.7112	2nd	
Frequency and depth of performance opportunity assessment	4.2	0.7011	3rd	
Hold People Accountable with a Sequential Governance Model	**4.4**	**0.9299**		**3rd**
Status of outstanding strategic objectives	4.5	0.9954	1st	
Volume and status of all improvement activities	4.4	0.8644	2nd	
Operational maturity profile of the organisation	4.3	0.8221	3rd	
Functional Integration	**4.5**	**0.9299**		**1st**
The project is designed around processes, product and customers	4.5	0.9923	1st	
Multifunctional teams optimise processes and value streams to deliver product	4.4	0.9113	2nd	

Source: field data, 2019

4.4.2 Challenges of Sustainability of Continuous Improvement

Twelve (12) items were adopted from (Hammond et al., 1996; Guide, 2000; Lundmark et al., 2009) to measure the challenges of sustainability of continuous improvement of the office complex project. Respectively, the study rearticulated the dimensions of challenges of sustainability of continuous improvement as outlined below. The descriptive statistics of the items and their overall average score are shown in Tables 4.5. Though the challenges of sustainable continuous improvement are not exhaustive, the ones relevant to the construction sector were adopted.

Industry Level Challenge was measured by three dimensions - Technological challenges affect the project outcome, Changes in customer preference and High labour cost. High labour cost was ranked first with mean and standard deviation values of 4.5 and 0.9612 respectively. Again, Changes in customer preference was ranked second with the mean value of 4.4 and a standard deviation of 0.9112. Technological challenges affect the project outcome was ranked third with the mean and standard deviation values of 4.3 and

0.8761. The analysis showed that High labour cost was a very crucial factor in the office complex project. Overall, Industry Level Challenge had a mean value of 4.4 and standard deviation of 0.9299.

Regarding System Level Challenges, respondents ranked Different product life-cycle stakeholders the highest with mean and standard deviation values of 4.5 and 0.9221 respectively. Further, Constructor complexity was also ranked second with a mean value of 4.4 and standard deviation of 0.8991. Overall, System Level Challenges had a mean value of 4.5 and standard deviation of 0.8415 indicating that System Level Challenges played a significant challenge in the construction of the office complex project.

More importantly, Material Flow Challenges was measured by three dimensions. Demand and supply challenges, Cost efficiency and effectiveness challenges and Inventory control management problems. Interestingly, Demand and supply challenges was ranked to be the second-highest with a mean and standard deviation values of 4.4 and 0.9911 respectively. Again, Cost efficiency and effectiveness challenges was ranked second with the mean value of 4.5 and standard deviation of 0.8912 and Inventory control management problems was ranked third with a mean value of 4.3 and standard deviation of 0.9245. Overall, Material Flow Challenges had a mean value of 4.4 and standard deviation of 0.9245 indicating that Material Flow Challenges was very important challenge for the project.

Information and Knowledge Challenges was measured by two dimensions. Insufficient product information sharing among product life-cycle actors and Failure to utilise learning capability. In this respect, respondents ranked insufficient product information sharing among product life-cycle actors the highest with mean and standard deviation values of 4.4 and 0.9221 respectively. Further, Failure to utilise learning capability was also ranked second with a mean value of 4.3 and standard deviation of 0.8991. Overall, Information and Knowledge Challenges had a mean value of 4.4 and standard deviation of 0.8415 indicating that System Level Challenges played a significant challenge in the construction of the office complex project.

Design for Construction Challenges was measured by two dimensions. Design is rarely applied in the product development process and unestablished routine and communication practices between multidisciplinary product development teams. In this regard, respondents ranked Design is rarely applied in the product development process the highest with a mean and standard deviation values of 4.5 and 0.9121 respectively. Further, unestablished routine and communication practices between multidisciplinary product development teams was also ranked second with a mean value of 4.4 and standard deviation of 0.8091. Overall, Design for Construction Challenges had a mean value of 4.5 and standard deviation of 0.8415 indicating that System Level Challenges played a significant challenge in the construction of the office complex project

Table: 4.5 Challenges of Sustainability of Continuous Improvement

Challenges of Sustainability of Continuous Improvement	***Mean***	***St. Dev***	***Rank***	***Overall Ranking***
Industry Level Challenge	**4.4**	**0.9299**		**5th**
Technological challenges affect the project outcome	4.3	0.8761	3rd	
Changes in customer preference	4.4	0.9112	2nd	
High labour cost	4.5	0.9612	1st	
System Level Challenges	**4.5**	**0.8415**		**1st**
Different product life-cycle stakeholders	4.5	0.9221	1st	
Constructor complexity	4.4	0.8991	2nd	
Material Flow Challenges	**4.4**	**0.9245**		**4th**
Demand and supply challenges	4.4	0.9911	2nd	
Cost efficiency and effectiveness challenges	4.5	0.8912	1st	

Inventory control management problems	4.3	0.9245	3rd	
Information and Knowledge Challenges	**4.4**	**0.8415**		**3rd**
Insufficient product information sharing among product life-cycle actors	4.4	0.9221	1st	
Failure to utilise learning capability	4.3	0.8991	2nd	
Design for Construction Challenges	**4.5**	**0.8415**		**1st**
Design is rarely applied in the product development process	4.5	0.9121	1st	
Unestablished routine and communication practices between multidisciplinary product development teams	4.4	0.8091	2nd	

4.4.3: Mitigation Strategies

Mitigation strategies was measured by five (5) items. Respectively, the study restated the dimensions of mitigation strategies as outlined below. The descriptive statistics of the items and their overall average score are shown in Tables 4.6.

Implementing Standard Operations, Instructions and Checklists was measured by two dimensions. Develop a base for a Monitoring and Reporting Platform system at the construction site and Proper project communication to enhance construction quality. The result indicated that Develop a base for a Monitoring and Reporting Platform system at the construction site is one of the crucial mitigating strategies with the mean value with the mean and standard deviation values of 4.5 and 0.9112 respectively. Again, Proper project communication to enhance construction quality had the mean value of 4.4 and standard deviation of 0.9132. The analysis showed that Develop a base for a Monitoring and Reporting Platform system at the construction site very good mitigation strategy.

Overall, implementing standard operations, instructions and checklists had a mean value of 4.5 and standard deviation of 0.9299 indicating that it was significant to the project.

Implementing Continuous Flow was measured by two dimensions. Greater employee involvement in the construction process and Link the separate construction steps in smooth undisrupted chain. Greater employee involvement in the construction process was ranked first with the mean and standard deviation values of 4.5 and 0.9514 respectively. Again, Link the separate construction steps in smooth undisrupted chain had the mean value of 4.4 and a standard deviation of 0.9131. The analysis showed that Greater employee involvement in the construction process was also an important mitigation strategy on the office complex project. Overall, Implementing Continuous Flow had a mean value of 4.5 and standard deviation of 0.9299 indicating that Implementing Continuous Flow was a good strategy to mitigate the challenges on the project.

Employing the Kanban Ordering System was measured by two dimensions. Control process pace by sending signals upstream that reflect customer demand and Inventory control management effectiveness. Respondents ranked Control process pace by sending signals upstream that reflect customer demand first with the mean value of 4.4 and a standard deviation of 0.8819. Again, Inventory control management effectiveness was ranked second with the value of 4.3 and standard deviation of 0.8112. Overall, Employing the Kanban Ordering System mean value of 4.3 and standard deviation of 0.9299.

Organising Employee Cross-Training and Learning through Problem Solving was also measured by two-dimension. Knowledge sharing among employee through training, Development of common platform for efficient and effective problem solving and

Creation of safe workplace to generate partnering relations with construction Knowledge sharing among employee through training had a mean value of 4.4 and standard deviation of 0.9337 whilst Development of common platform for efficient and effective problem solving had mean and standard deviation values of 4.2 and 0.8612. Again, Creation of safe workplace to generate partnering relations with construction had mean value of 4.5 and standard deviation of 0.9918. Overall, Organising Employee Cross-Training and Learning through Problem Solving had a mean value of 4.3 and standard deviation of 0.9299 indicating that Organising Employee Cross-Training and Learning through Problem Solving is significant mitigating strategy to the challenges of sustainability of continuous improvement of the office complex project.

Designing Factory Layout for Continuous Flow was measured by only one dimension. Layout improvement to facilitate communication among employees. It had mean and standard deviation values of 4.4 and 0.8771 respectively.

Table 4.6: Mitigation Strategies

Mitigation Strategies	*Mean*	*St Dev*	*Rank*	*Overall Ranking*
Implementing Standard Operations, Instructions and Checklists	**4.5**	**0.9299**		**1st**
Develop a base for an MRP system at the construction site	4.5	0.9112	1st	
Proper project communication to enhance construction quality	4.4	0.9132	2nd	
Implementing Continuous Flow	**4.5**	**0.9299**		**1st**
Greater employee involvement in the construction process	4.5	0.9514	1st	
Link the separate construction steps in smooth undisrupted chain	4.4	0.9131	2nd	
Employing the Kanban Ordering System	**4.3**	**0.9299**		**4th**
Control process pace by sending signals upstream that reflect customer demand	4.4	0.8819	1st	

Inventory control management effectiveness	4.3	0.8112	2nd	
Organising Employee Cross-Training and Learning through Problem Solving	**4.3**	**0.9299**		**4th**
Knowledge sharing among employee through training	4.4	0.9337	2nd	
Development of common platform for efficient and effective problem solving	4.2	0.8612	3rd	
Creation of safe workplace to generate partnering relations with construction	4.5	0.9918	1st	
Designing Factory Layout for Continuous Flow	**4.4**	**0.8771**		**3rd**
Layout improvement to facilitate communication among employees	4.4	0.8771	1st	

4.5 Discussion

Sustainability of Continuous Improvement or innovation efforts is critical in the success of a construction sector today. Having differentiation through solely product and price alone will not ensure sustainable competitive advantage. However, by incorporated a sustainable innovation and creativity within the operation of the sector, the sector can sustain its competitive advantage and business.

Haikonen et al., (2004) posits that continuous improvement (CI) is a very critical tool in the construction industries today to enhance customer satisfaction, to become the cost leader and also to remain competitive in the global world today. Companies such as Seagate, Agilent, Motorola and so on employed Six Sigma as the CI tool to improve product quality and also ensure customer satisfaction in their products and services. The reliability, timeliness, accuracy and perceived value of the products or services have become the keys to organizational success. The business environment has become turbulent, complex and even chaotic. At the same time business processes have evolved toward non-routine operations making project type working increasingly common in every business (Haikonen et al., 2004).

However, due to sustainable continuous improvements challenges such as Industry Level Challenge, System Level Challenges, Material Flow Challenges, Information and Knowledge Challenges and Design for Construction Challenges, project success is not always ensured in most construction projects. In an attempt to contribute to these findings, the present study relied on sample of 35 construction workers to examine Sustainability of Continuous Improvement in the Construction Sector: A Case of Office Complex Project in Tamale Metropolis.

4.5.1 Components of Sustainability of Continuous Improvement

Evidence indicated that with components of sustainability of continuous improvement, respondents ranked functional integration very important. Again, building understanding with a perspective content was also seen to be very good component of sustainability improvement. The analysis showed that engaging the organisation with structured development and drive execution with a well-defined managing process were equally important. Overall, functional integration was perceived to be the most significant component of sustainability of continuous improvement on the Construction of Office Complex Project. The current findings commensurate the findings of Boyko et al., (2006) who argued that functional integration improvement ensures quality, maintenance, demand and supply planning and the various continuous improvement methodologies used are on the same platform and are executed simultaneously and in concert with one another. Again, the findings of De Jong et al., (2007) agreed with the current study's findings in that managing process ensure that continuous improvement is given appropriate focus and attention. The managing process was crucial to the success of the production system implementation and that rituals and routines that need to be established as part of the overall site managing process include Strategy development and execution management, Improvement project identification, prioritization, and execution management, Functioning of improvement teams, Frequency and depth of performance opportunity assessment, Frequency of re-assessment against the practice maturity model and updating of the implementation plan generated from the re-assessment and Objective third party milestone assessments.

4.5.2 Challenges of Sustainability of Continuous Improvement

Given these questions, the results suggest that design for construction is the most challenging sustainable continuous improvement of the construction project. More importantly, system-level challenges especially different product life-cycle stakeholders was one of the major challenges of sustainability of continuous improvement of the project. It was indicated that industry-level material, and information level challenges also have great impact in terms of challenges on the office complex project. The findings agreed with the findings of (Hammond et al., 1996; Guide, 2000; Lundmark et al., 2009) who posited that internal uncertainties typically originate from the construction firm's internal process challenges, while external uncertainties depend on the challenges outside the construction firm. Again, the findings agreed with the findings of to Guidat et al. (2015) who argue that industry challenges come from sceptical customer perception, variable inflow of cores (used and returned worn-out products or their parts), and labour costs versus product value.

4.5.3 Mitigation Strategies

Evidence indicated that implementing standard operations, instructions and checklists was ranked the most important in so far as mitigation is concerned. Implementing continuous flow was also very important mitigation strategy. Designing factory layout for continuous flow especially layout improvement to facilitate communication among employees. These current findings were in consonance with the findings of Bouzon et al., (2012) who posited that an appropriate layout design contributes to process improvements and workshop capacity utilization and that lean layout construction firms are able to create a continuous material and information flow and improve the control of inventory. Furthermore, the findings of McLaughlin et al., (2013) agreed with the current study's findings in that layout improvements facilitate communication between employees working at the site and that achieving a lean layout is a challenging but realistic task for construction firms working with product disassembly assembly tasks. More importantly, the study's findings agreed with Bicheno et al., (2009) who asserted that essential element of the continuous improvement leads to the establishment and maintenance of standardized work tasks, the development of a platform for efficient and effective problem solving, the creation of a safe workplace, and the generation of partnering relations with contractors.

4.6 Chapter Conclusion

This chapter presented the study's results and findings. It also discussed the findings in relation to the study's objectives, underpinning theories, and the pertinent literature. The subsequent chapter presents the summary of the findings, conclusion, and recommendation of the study.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

Sustainability, in a broad sense, is the capacity to endure. All the needs of current and future generations for survival and well-being depend largely on the natural environment, either in a direct or an indirect way. Sustainability aims to create and maintain the environmental, social and economic conditions that allow humans to exist with nature in "productive harmony" in the present and the future (USEPA, 2009). Sustainability has become a wide-ranging term that can be applied to almost every facet of life on Earth, ranging from a local to a global scale and over various time periods. The Office Complex Project was designed with sustainability as the base.

For the purpose of the aforementioned point, the purpose of the study was to examine the sustainability of continuous improvement in the construction sector focusing specifically on the construction of the office complex project at Tamale Metropolis. This chapter of the study provided a summary of the study findings in congruence with the stated research objectives. The chapter also presented thorough conclusion and recommendations based on the findings discovered by the study. The recommendations of the study covered two broad areas namely policy or practical recommendations and future research recommendations. Whilst the practical recommendations cover steps to improve continuous improvement in sustainability regarding the Office Complex Project, future research recommendations covered information for future researchers on the topic understudy.

5.2 Review of Findings

Regular evaluations are required to ensure that continuous improvement is integrated into the organization culture. Continuous improvement must be incorporated as part of the daily task or responsibilities of all the employees. This included changes in the organization’s structure, systems, procedure as well as the methods and mechanism that are used to develop continuous improvement support and strengthen each other (Bessant et al., 1997).

Further, Bessant et al., (1997) iterate that integration involves managing the organizational changes to make continuous improvement a common practice and that there are numerous methodologies such as Six Sigma, the concept for continuous improvement. Again, they argued that these methodologies provide the construction industry ways and tools to streamline the construction industry structure in terms of communication, motivation or employees and therefore the integration of changes must be managed appropriately to ensure that continuous improvement can be sustained for long term. Communication of changes in the sector and the purposes of such changes are important to ensure that employees know clearly the construction goals and align their process improvement to achieve the goals.

5.2.1 Review of the Components of Sustainable Continuous Improvement

The first objective of the study was to identify the Components of Sustainable Continuous Improvement on the Office Complex Project. The study found that functional integration is the most important components of sustainable continuous improvement.

5.2.2 Review of the Challenges Sustainable Continuous Improvement

The second objective of the study was to identify Challenges Sustainable Continuous Improvement of the Office Complex Project. The study indicated design for construction challenges is one major challenge on the project.

5.2.3 Review of Mitigation Strategies

The third objective of the study was to suggest ways of mitigating the challenges of sustainable continuous improvement. The study found that implementing standard operations, instructions and checklists and implementing continuous flow were the most significant mitigating strategies to the challenges of the project.

5.3 Conclusion

The research sought to identify the potential challenges inhibiting the implementation of sustainable continuous improvement in the construction sector specifically the office complex project in the Tamale Metropolis and the analysis made brought the researcher to the following conclusion of the study. From the responses above, respondents still view the design for construction as a major challenge. These challenges are Design is rarely applied in the product development process; and Unestablished routine and communication practices between multidisciplinary product development teams.

Despite all these challenges, the study further concluded that the employees in the office complex project think that implementing standard operations, instructions and checklists by, "Develop a base for a MRP system at the construction site; Proper project communication to enhance construction quality" as well as continuous flow through "Greater employee involvement in the construction process; and Link the separate construction steps in smooth undisrupted chain" will significantly help mitigate the challenges associated with the implementation of continuous improvement.

5.4 Recommendations

Based on the findings the following recommendations are provided;

The study found that the Office Complex Project is a good project and therefore provide tangible benefits. Therefore, it was recommended that;

1. Project implementers use Functional Integration as the main component in implementing sustainable continuous improvement by designing the project around processes, product and customers and also having Multifunctional teams optimise processes and value streams to deliver product. To achieve this, the project team

ought to be given the required project management orientation in order to improve their performance and programme delivery.

2. Constructors especially, workers on the Office Complex Project have formal analysis of the mitigating strategies to the challenges associated with continuous improvement.

5.5 Recommendations for Future Research

The following future research recommendations are provided;

Future researchers can examine the other project management implementation challenges of Office Complex Projects in the construction industry in Ghana and how this affects economic growth and development. Future researchers can explore the implementation strategies of the Office Complex Project and how these contribute to socio-economic development.

5.6 Limitations

Despite the refined results, the study was not without limitations.

First and foremost, the willingness of respondents to answer the questionnaire posed a great hindrance to the progress of the study. In addition, even though, a nationwide study would have been much worthwhile for the purposes of national reflection on the subject, there were to some extent financial and informational resources constraints which prevented the impracticality of undertaking such an exercise

REFERENCE

Aliyu, H., & Knight, P. (2014). *Interviewing for Social Scientists*. London: Sage.

Anthony, K.R., Hoogenboom, M.O., Maynard, J.A., Grottoli, A.G. and Middlebrook, R., 2009. Energetics approach to predicting mortality risk from environmental stress: a case study of coral bleaching. *Functional ecology*, *23*(3), pp.539-550.

Axtell, C. M., Holman, D. J., Unsworth, K. L., Wall, T. D., Waterson, P. E., & Harrington, E. (2000). Shop floor innovation: Facilitating the suggestion and implementation of ideas. *Journal of Occupational and Organizational Psychology*, 73, 265–285. doi:10.1348/096317900167029 [Crossref], [Web of Science ®], [Google Scholar].

Ball, K. and wood, R. (1995), “Sustainable competitive advantage: towards a dynamic resource-based strategy”, Management Decision, Vol. 37 No. 1, pp. 45-50.

Bae, J.-W., and Kim, Y.-W. (2008). "Sustainable Value on Construction Projects and Lean Construction." *Journal of Green Building*, 3(1), 156–167.

Baah-Ennumh, T. Y. & Adom-Asamoah, G. (2012). The Role of Women in the Informal Economy of Ghana. Journal of Science and Technology, 32(2), 56 – 67.

Benavent, F.B., Ros, S.C. and Moreno-Luzon, M. (2004), "A model of quality management self-assessment: an exploratory research", International Journal of Quality & Reliability

Berger, A. (1997), "Continuous improvement and kaizen: standardization and organizational designs", Integrated Manufacturing Systems, Vol. 14 No. 1, pp. 7-28.

Bernard HR. (2002). Research methods in anthropology: Qualitative and quantitative approaches. 3rd Alta Mira Press; Walnut Creek, CA: 2002.

Bessant, J. and Caffyn, S. (1997), "High involvement innovation through continuous improvement", International Journal of Technology Management, Vol. 14 No. 1, pp. 7-28.

Bicheno, E. E. & Bridges K. (2009). The Architectural Technologist's Role in Linking Lean Design with Lean Construction. Elsinore.

Boyko, C.T., Cooper, R., Davey, C.L. and Wootton, A.B. (2006). Addressing sustainability early in the urban design process', in International Journal of Management of Environmental Quality, 17(6), 689–706.

Bouzon N., Rameezdeen, R. and Hosseini, M.R., 2012. Drivers for adopting reverse logistics in the construction industry: a qualitative study. *Engineering, Construction and Architectural Management*, *23*(2), pp.134-157.

Breen, B. & breen M. (2011). Applying Lean Thinking and Principles in Building Design. Provincial Health Services Authority, British Columbia, Canada.

Brewer, A.M. (1996), "Developing commitment between managers and employees", Journal of Managerial Psychology, Vol. 11 No. 4, pp. 24-34.

Brundtland, G.H., 1987. Our common future—Call for action. *Environmental Conservation*, *14*(4), pp.291-294.

Caldwell, B. and Babbie J. (2011). Beyond Positivism. Economic Methodology in the Twentieth Century. New York, US: Routledge.

Campos, I. B., Oliveira, D. M. de, Carneiro, S. B. M., Carvalho, A. B. L. de, and Neto, J. P. B. (2012). "Relation Between the Sustainable Maturity of Construction companies and the philosophy of lean construction." *20th Ann. Conf. of the Int' l Group for Lean Construction*, I.

Carneiro, S. B. M., Campos, I. B., Oliveira, D. M. de, and Neto, J. P. B. (2012). "Lean and Green: A Relationship Matrix." *20th Ann. Conf. of the Int'l Group for Lean Construction*, I. D. Tommelein and C. L. Pasquire, eds., San Diego, USA.

Chaharbaghi, K. and Lynch, R. (1999), "Sustainable competitive advantage: towards a dynamic resource-based strategy", Management Decision, Vol. 37 No. 1, pp. 45-50.

Chan, A., Holbrook, B. and Atkinson, P. (2017), 'Qualitative Data Analysis: Technologies and Representations', *Sociological Research Online*, vol. 1, no. 1. http://www.socresonline.org.uk/1/1/4.html.

Chapman, R.L., Murray, P.C. and Moller, R. (1997), "Strategic quality management and financial performance indicators", International Journal of Quality & Reliability Management, Journal of Manufacturing Technology Management, Vol. 15 No. 4, pp. 369-378.

Cox, R. F., Issa, R. R. A., ASCE, M., and Ahrens, D. (2003). "Management's Perception of Key Performance Indicators for Construction." *Journal of Construction Engineering and Management*, 129(2), 142–151.

Cresswell, J.W., Bokun, T., McKinstry, B., Procter, R., Majeed, A. and Sheikh, A., 2011. The impact of eHealth on the quality and safety of health care: a systematic overview. *PLoS medicine*, *8*(1), p.e1000387.

Creswell, J.W. 1994. *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage publications.

De Jong, J. and Den Hartog, D. (2007), "How leaders influence employees' innovative behaviour", European Journal of Innovation Management, Vol. 10 No. 1, pp. 41-64. development: preliminary case study findings on management role", Journal of Manufacturing Technology Management, Vol. 15 No. 4, pp. 369-378.

Emmitt, S., Sander, D. And Christoffersen, A.K. (2004). Implementing Value Through Design Management. IGLC 2004, Helsingor.

Escrig-Tena, A.B. (2004), "TQM as a competitive factor a theoretical and empirical analysis", effectiveness on sustainability improvement in the UK construction industry.

Field, B. and Ofori, G. (1988). Construction and economic development – a case study in Third World Planning Review, 10(1), 41–50.

Friends of the Earth. (1995). Prescription for Change: Health and the Environment, Brussels, Friend of the Earth.

Gomes, C.F., Yasin, M.M. and Lisboa, J.V. (2005), "Performance measurement practices in manufacturing firms: an empirical investigation", Journal of Manufacturing Technology International Journal, Vol. 19 No. 2, pp. 213-221.

Guidat R, Page T, Dubina H, Fillipi G, Guidat R, Patnaik S, Poechlauer P, Shering P, Guinn M, Mcdonnell P, Johnston C. (2015). Equipment and analytical companies meeting continuous challenges. May 20-21, 2014 Continuous Manufacturing Symposium. GEA Pharma Systems Ltd., Eastleigh, Hampshire, SO53 4ZD, UK.

Guide, B. (2000). Developing a questionnaire. London: Continuum.

Haikonen, A., Savolainen, T. and Ja¨rvinen, P. (2004), "Exploring Six Sigma and CI capability in the light of new institutional economics", Management of Environmental Quality: An International Journal, Vol. 19 No. 2, pp. 213-221.

Hammond, Z., Slany, W., and Holzinger, A. (1996). "Current state of agile user-centered design: A survey", HCI and Usability for e-Inclusion, pp. 416–427.

Holmberg, J. and Sandbrook, R. (1992). Sustainable development: What is to be done?', in J. Holmberg (ed), Policies for a Small Planet, London, Earthscan.

Horman, M. J., Riley, D. R., Lapinski, A. R., Korkmaz, S., Pulaski, M. H., Magent, C. S., Luo, Y., Harding, N., and Dahl, P. K. (2006). "Delivering Green Buildings: Process Improvements for Sustainable Construction." *Journal of Green Building*, 1(1), 123–140.

Huovila, P., and Koskela, L. (1998). "Contribution of the Principles of Lean Construction to Meet the Challenges of Sustainable Development." *6th Ann. Conf. of the Int'l Group for Lean Construction*, Guarujá, Brazil. International Journal of Quality & Reliability Management, Vol. 21 No. 6, pp. 612-637.

Imai, M. (1986) Kaizen: The Key to Japan's Competitive Success. McGraw-Hill Education, New York.

Israel, Glen D. (1992) Determining Sample Size, Agricultural Education and Communication Department, University of Florida, IFAS Extension, PEOD6 (Reviewed 2013)

Jackson, P.R. (2003), "Employee commitment to quality its conceptualization and measurement", International Journal of Quality & Reliability Management, Vol. 21 No. 7, pp. 714-730.

Johnson, D.M. (2003), "Adaptation of organizational change models to the implementation of continuous improvement".Journal of Occupational & Organizational Psychology, Vol. 20 No. 3, pp. 497-515.

Kaboub, F. (2008). Positivist Paradigm. In F. Leong (ed.), Encyclopedia of Counseling (p.785).

Kanban, I. (2010). Social and economic aspects of sustainable development.

Kates, R. W., Parris, T. M., and Leiserowitz, A. A. (2005). “What Is Sustainable Development?” *Environment*, 47(3), 8–21.

Klotz, L., Horman, M., and Bodenschatz, M. (2007). “A Lean Modeling Protocol for Evaluating Green Project Delivery.” *Lean Construction Journal*, 3(1).

Koskela, L. (1992) Application of the New Production Philosophy to Construction, Technical Report No. 72. Center for Integrated Facility Engineering. Department of Civil Engineering. Stan-ford University. 75 p.

Koskela, L. (2004). Moving-on – Beyond Lean thinking. Lean Construction Journal, 1(1), 24-37.

Kudlak, R. (2008), “Adaptation of enterprise to the requirements of sustainable development.

Kuei, C.H. and Madu, C.N. (2003), “Customer-centric six sigma quality and reliability management”, International Journal of Quality & Reliability Management, Vol. 20 No. 8, pp. 954-964.

Kumar, P., Wang, J.M. and Bernabeau, C., 1996. CD105 and angiogenesis. *The Journal of pathology*, *178*(4), pp.363-366.

Laedre, O., Haavaldsen, T., Bohne, R. A., Kallaos, J., and Lohne, J. (2015). “Determining sustainability impact assessment indicators.” *Impact Assessment and Project Appraisal*, 33(2), 98–107.

Langlo, J. A., Bakken, S., Karud, O. J., Malm, E., and Andersen, B. (2013). *Måling av produktivitet og prestasjoner i byggenæringen*. SINTEF, Trondheim.

Lapinski, A. R., Horman, M. J., and Riley, D. R. (2006). "Lean Processes for Sustainable Project Delivery." *Journal of Construction Engineering and Management*, 132(10), 1083–1091.

Leede, J.D. and Looise, J.K. (1999), "Continuous improvement and the mini-company concept", International Journal of Operations & Production Management, Vol. 19 No. 11, pp. 1188-1202.

Ling, Y., Floyd, S. W., & Baldridge, D. C.(2008). Reading the winds in multinational corporations: The impact of culture on issue selling behavior. Journal of International Business Studies, 36: 637-654

Liu, Y., (2008). A broadly neuroprotective derivative of curcumin. *Journal of neurochemistry*, *105*(4), pp.1336-1345.

Lowe, J.L. (2003). Construction Economics. [Online]. Available from: www.callnetuk.come/home/johnlowe 70/ (Accessed 15 August 2012).

Lundmark K. and Lowe, J.L. (2009). Construction Economics. [Online]. available from: www.callnetuk.come/home/johnlowe 70/ (Accessed 15 August 2012).

Martensen, A. and Dahlgaard, J.J. (1999), "Strategy and planning for innovation management – supported by creative and learning organizations", International Journal of Quality & Reliability Management, Vol. 16 No. 9, pp. 878-891.

McLaughlin, K.A., Koenen, K.C., Hill, E.D., Petukhova, M., Sampson, N.A., Zaslavsky, A.M. and Kessler, R.C., 2013. Trauma exposure and posttraumatic stress disorder in a national sample of adolescents. *Journal of the American Academy of Child & Adolescent Psychiatry*, *52*(8), pp.815-830.

Melles, B. and Wamelink, J. W. F. (1993). Production Control in Construction. Delft University Press, Delft, The Netherlands.

Miller, A. (2004). "Defect Costs in Residential Construction." Journal of Construction Engineering and Management, Vol 135, No. 1, 12-16.

Mthalane, D., Othman, A.A.E. and Pearl, R.G. (2007). The economic and social impacts of site accidents on the South African society', in J.J.P. Verster and H.J. Marx (eds), in Proceedings of the 5th Post Graduate Conference on Construction Industry Development, Bloemfontein, South Africa, March 2008, 1–10.

Mugenda, O.M. and Mugenda, A.G. (2009) Research Methods, Quantitative and Qualitative Approaches

O'Shannassy, T. (2008), "Sustainable competitive advantage or temporary competitive advantage", Journal of Strategy and Management, Vol. 1 No. 2, pp. 168-180 of Environmental Quality: An International Journal, Vol. 23 No. 2, pp. 126-139 of quality standard requirements", International Journal of Quality & Reliability Management, Vol. 21 No. 2, pp. 154-174.

Othman, A.A.E. (2010) Incorporating Innovation and Sustainability for Achieving Competitive Advantage in Construction. In: Wallis, I., Bilan, L., Smith, M. and Kazi, A.S. (eds.) Industrialised, Integrated, Intelligent sustainable Construction I3CON Handbook2, pp. 13-42.

Perez-Araos, A., Barber, K.D., Munive-Hernandez, J.E. and Eldrige, S. (2006), “Designing a knowledge management tool to support knowledge sharing networks”, Journal of Manufacturing Technology Management, Vol. 18 No. 2, pp. 153-168.

Platje, J. (2008), “An institutional capital approach to sustainable development”, Management of Environmental Quality: An International Journal, Vol. 19 No. 2, pp. 222-233.

Project Development Team (1999).

Reed, J. and Vakola, M. (2006), “What role can a training needs analysis play in organizational change?” Journal of Organizational Change Management, Vol. 19 No. 3, pp. 393-407.

Ruben A & Babbie E (1989). *Research methods for social work. Belmont, Wadsworth* CA 1989.

Rubin, D.B. and Babbie J. (1989). Multiple Imputation for Nonresponse in Surveys. New York: Wiley.

Saunders, H. (2007). Case Study Research in Practice. SAGE, London.

Saunders, M., Lewis, P. and Thornhill, A. (2009) Research Methods for Business Students. Pearson, New York

Spradley JP. (1979). The ethnographic interview. Holt, Rinehart & Winston; New York: 1979.

Sugimori, S. and Wijesiri, D. (1977) Lean construction as a strategic option: testing its suitability and acceptability in Sri Lanka. *Lean Construction Journal*, 34-48.

Terziovski, M. (2002), “Achieving performance excellence through an integrated strategy of radical innovation and continuous improvement”, Measuring Business Excellence, Vol. 6No. 2, 5-14

Thurairajah, N., Haigh, R. and Amaratunga, R.D.G (2006), “Leadership in Construction Partnering Projects: Research Methodological Perspectives”, In Stephenson, P. and Akintoye, A. (eds.), *ARCOM Doctoral Workshop*, Glasgow Caledonian University.

Toor, S.-R., and Ogunlana, S. O. (2010). “Beyond the ‘iron triangle’: Stakeholder perception of key performance indicators (KPIs) for large-scale public sector development projects.” *International Journal of Project Management*, 28(3), 228–236.

Trochim (2006). Research Methodology. Design and methods (4th Ed.). Thousand Oaks, CA: Sage.

Ugwu, O. O., and Haupt, T. C. (2007). “Key performance indicators and assessment methods for infrastructure sustainability—a South African construction industry perspective.” *Building and Environment*, 42(2), 665–680.

United Nations Environment Programme. (2009). *Buildings and Climate Change*. UNEP, Paris.

USEPA. (2009). Basic Information. Retrieved March 19, 2012, from The United States Environmental Protection Agency (USEPA). [Online]. Available from:

Valente, C. P., Mourão, C. A. M. A., and Neto, J. de P. B. (2013). “Lean and green how both philosophies can interact on strategic, tactical and operational levels of a company.” *21th Ann. Conf. of the Int'l Group for Lean Construction*, C. T. Formoso and P. Tzortzopoulos, eds., Fortaleza, Brazil, 925–9

World Commission on Environment and Development (1987). Our Common Future, Oxford, Oxford University Press.

Yin, R. K. (2009). Case study research: Design and methods (4th Ed.). Thousand Oaks, CA: Sage.

Zairi, M. and Whymark, J. (2000), “The transfer of best practices: how to build a culture of A china study”, *Resources, Conservation and Recycling*, 54, pp. 931–936.

Zikmund, W.G, Lewis, P. and Thornhill, A. (2009) Research Methods for Business Students. Pearson, New York

APPENDIX

QUESTIONNAIRE

My name is **WIYOR ERIC N-MAWISEH.** I am a final year MSC Project Management student from Department of Construction Technology and Management at Kwame Nkrumah University of Science and Technology, Kumasi. As part of the requirement for the master's degree, I am conducting a research on the topic**: Sustainability of Continuous Improvement in the Construction Sector: A Case of Office Complex Project in Tamale Metropolis.**

The objectives of the study include:

4. To identify the components of sustainable continuous improvement of the office complex project in Tamale.

5. To identify the challenges of sustainable continuous improvement.

6. To suggest ways of mitigating the challenges of sustainable continuous improvement.

The implication of the findings is for future implementation of Sustainability of Continuous Improvement in Ghana and other countries. Information given will be treated with utmost confidentiality.

Thank you for your participation and assistance with this study.

SECTION A: RESPONDENT PROFILE

1. Please Tick [√] to indicate your position in the company.

a. Operator [ ]

b. Project Manager [ ]

b. Site Engineer [ ]

d. Site Foreman [ ]

e. Health and safety officer [ ]

2. Tick [√] to indicate your educational level

a. PhD [ ]

a. MSc [ ]

b. BSc [ ]

c. HND [ ]

d. Technician (CTC I,II and III) [ ]

3. Tick [√] to indicate how long you have been involved in construction projects

1. Over 20 years [ ]

2. 16-20 years [ ]

3. 11- 15 years [ ]

4. 6-10 years [ ]

5. Up to 5 years [ ]

SECTION B: COMPONENTS OF SUSTAINABILITY OF CONTINUOUS IMPROVEMENT

On the scale of 1-5, please indicate by ticking [√] the appropriate cell in relation to the component of sustainability of continuous improvement on the Office Complex Project in Tamale Metropolis

1	***2***	***3***	***4***	***5***
Strongly Disagree	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***

Components	1	2	3	4	5
Building Understanding with a Perspective Content Framework					
There is employee empowerment that intersect capability and accountability					
Continuous improvement approach is put into meaningful context					
There is a practical consideration to develop content model for continuous improvement					
Engage the Organisation with a Structured Deployment Approach					
The is employee engagement					
Management process and governance model is established					
There is investment in capability building that create return on investment					

Drive Execution with a Well-Defined Managing Process					
There is strategy development and execution management					
Improvement project identification, prioritisation and execution					
Frequency and depth of performance opportunity assessment					
Hold People Accountable with a Sequential Governance Model					
Status of outstanding strategic objectives					
Volume and status of all improvement activities					
Operational maturity profile of the organisation					
Functional Integration					
The project is designed around processes, product and customers					
Multifunctional teams optimise processes and value streams to deliver product					

SECTION C: CHALLENGES OF SUSTAINABILITY OF CONTINUOUS IMPROVEMENT

On the scale of 1-5, please indicate by ticking [√] the appropriate cell in relation to the challenges of sustainability of continuous improvement on the Office Complex Project in Tamale Metropolis

1	***2***	***3***	***4***	***5***
Strongly Disagree	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***

Challenges	1	2	3	4	5
Industry Level Challenge					
Technological challenges affect the project outcome					
Changes in customer preference					
High labour cost					
System Level Challenges					
Different product life-cycle stakeholders					
Constructor complexity					
Material Flow Challenges					
Demand and supply challenges					
Cost efficiency and effectiveness challenges					
Inventory control management problems					
Information and Knowledge Challenges					
Insufficient product information sharing among product life-					

cycle actors					
Failure to utilise learning capability					
Design for Construction Challenges					
Design is rarely applied in the product development process					
Unestablished routine and communication practices between multidisciplinary product development teams					

SECTION D: MITIGATION STRATEGIES

On the scale of 1-5, please indicate by ticking [√] the appropriate cell in relation to the mitigation strategies used to overcome the challenges on the Office Complex Project in Tamale Metropolis

1	***2***	***3***	***4***	***5***
Strongly Disagree	***Disagree***	***Neutral***	***Agree***	***Strongly Agree***

Mitigation	1	2	3	4	5
Implementing Standard Operations, Instructions and Checklists					
Develop a base for a MRP system at the construction site					
Proper project communication to enhance construction quality					
Implementing Continuous Flow					
Greater employee involvement in the construction process					
Link the separate construction steps in smooth undisrupted chain					
Employing the Kanban Ordering System					
Control process pace by sending signals upstream that reflect customer demand					
Inventory control management effectiveness					
Organising Employee Cross-Training and Learning through Problem Solving					

Knowledge sharing among employee through training					
Development of common platform for efficient and effective problem solving					
Creation of safe workplace to generate partnering relations with construction					
Designing Factory Layout for Continuous Flow					
Layout improvement to facilitate communication among employees					