The Use of Six Sigma as a Performance Improvement Strategy in the Construction Industry: New Trends and Applications

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ABSTRACT

This paper explores new trends in Six Sigma and their applications as a means of improving construction performance. A review of past research findings revealed the existence of 18 Six Sigma applications. These applications were categorised under three Six Sigma trends namely, Six Sigma Off-Shoot, Six Sigma Hybrid I (Six Sigma and another concept) and Six Sigma Hybrid II (Six Sigma and two other concepts). The research review further identified 1 application under off-shoot, 10 applications under Hybrid I and 7 applications under Hybrid II. The most popular trend is Hybrid I with Lean Six Sigma as the most popular application whereas the newest trend is Hybrid II with Lean Six Sigma and Project Management as the latest application. The review concludes that all the 18 applications can be deployed in the construction industry as performance improvement strategies except 1 application, Six Sigma and Capability Maturity Model under Hybrid I.

Keywords— Construction, Improvement, Performance, Six Sigma

I. INTRODUCTION

Several management strategies have evolved in many organisations in order to ensure performance improvement [3]. Six Sigma has been identified as one of such strategies that has received attention in performance improvement due to the immense benefits associated to it [48]. It has yielded positive results in countless manufacturing [31] and service [48] organisations of various sizes.

The construction industry is not keeping pace with the world's development [29]. This is due to the high incidence of poor performance in construction project delivery [4]. Several researchers have ascribed various reasons for poor performance ranging from poor management practices [4] through client dissatisfaction [29] to improper practices by contractors [50]. The challenge of poor performance in the construction industry has persisted for a long time despite efforts made to overcome them making it a global challenge [4]. In order to address this challenge, there is the need to revisit the causes of poor performance and propose measures to address them [50]. A previous report by [29] has challenged the industry to develop methods that can identify clients' needs and their source of satisfaction. This can be achieved by integrating Six Sigma in construction processes [28][30][34]. Limited research has been conducted on developing definite performance improvement systems based on the Six Sigma technique in the construction industry.

This paper aims at exploring the possibility of integrating Six Sigma as an improvement strategy in the construction industry. It identifies the new trends in Six Sigma and explores the deployment of Six Sigma and its different applications in the construction industry as a performance improvement strategy bringing out the anticipated related opportunities. Literature will be reviewed on Six Sigma, new trends, and their application in the construction industry. The research identifies emerging trends in Six Sigma and the opportunities it provides for performance improvement in the construction industry.

II. LITERATURE REVIEW

Six Sigma is defined as a disciplined project-oriented statistically based approach for reducing process variability by eliminating defects from products and processes [33]. The Sigma symbol (σ) represents standard deviation in statistics and is used to measure the defects in a product or process [49]. That is the amount of variation within a normal data distribution and tolerance band. Hence, the Six Sigma level means that, for a particular process or product with a million opportunities, there is a defect rate of 3.4. Six Sigma’s Define, Measure, Analyse, Improve, Control (DMAIC) roadmap and its belt system have been widely accepted by organisations that adopt the concept [9]. There is a different model of Six Sigma that focuses on designing to achieve Six Sigma level of quality known as Design for Six Sigma (DFSS) [17]. The current trend in Six Sigma has been to merge the concept with other established concepts to create a
hybrid in order to improve performance [9][39].

Organisations have adopted Six Sigma or its different applications namely DFSS or other hybrids to improve their performance. This has transformed the concept from a continuous quality improvement technique into a management strategy that aids organisations to achieve competitive advantage [31]. The research focuses on the different Six Sigma applications.

A. Different Six Sigma Model – Design for Six Sigma

DFSS is an approach that moves the Six Sigma philosophy of variability reduction and process improvement from the manufacturing stage to the design stage [11]. DFSS has the potential to simplify design configurations while eliminating non-value-added steps which eventually reduce costs and is ideal for service organisations in general [6].

Contrary to the view of several researchers, DFSS is not a methodology of Six Sigma but rather a different model of Six Sigma [17]. It has been described as an off-shoot of Six Sigma which does not add depth nor alter the underlying principles of Six Sigma and has a wide variety of methodologies [23]. Examples are, Define, Measure, Analyse, Design, Verify (DMADV); Identify, Design, Optimise, Validate (IDOV); Define, Initiate, Design, Execute, Sustain (DIDES). However, they all employ the fundamental strategies and tools that promote the goal to create a data-driven product or process development culture [6]. Six Sigma on the other hand, has DMAIC as its widely accepted methodology [9].

There is evidence to show that DFSS has been applied to the construction industry with positive results using the Gatwick Airport project in Crawley, England as an example [40]. Identify, Measure, Analyse, Improve, Control, and Result (IMAICR) was applied to the airport project with each step religiously followed. The benefits include streamlined procedures, the coherent manner of defining the project delivery phases, proper checks and balances, and project and team uniformity.

From above, it is clear that DFSS is a distinct Six Sigma model and not a methodology of Six Sigma and is applicable to the construction industry. Its approach aims at designing products or services to meet the Six Sigma level using a wide variety of methodology depending on the expected output and organisation culture. Apart from this off-shoot, there are other different Six Sigma applications that emerged from a combination of Six Sigma and other concepts into hybrids.

B. Six Sigma Hybrid Applications

Researchers have outlined several limitations and challenges about the concept of Six Sigma ranging from weaknesses in its underling theory [31] to those related to process implementation [3] and project selection [36]. In response to these limitations, others present arguments to mitigate the challenges or debunk the assertions [20]. Even though several organisations have implemented Six Sigma successfully, it is important to note that some organisations have failed to improve performance after implementing the concept [41]. For instance, a survey carried out in 2005 on an aerospace company showed that the respondent’s satisfaction on Six Sigma results was below 50% [41].

This suggests that Six Sigma may not be enough hence the need for its adaptation. Some researchers have suggested innovative ideas in the Six Sigma concept by merging it with already established concepts to create hybrid concepts. Table I shows a list of Six Sigma applications identified in literature most of which are recommendations for future research.

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To this end, an attempt has been made to identify 17 hybrid applications of Six Sigma and one off-shoot totaling 18 different Six Sigma applications. These 18 applications can be classified into three trends namely the Six Sigma offshoot, Six Sigma hybrid I (Six Sigma and another concept) and Six Sigma hybrid II (Six Sigma and two other concepts). These are applicable in manufacturing, non-manufacturing and service areas of different industries. However, it is believed that little research has been conducted in the application of Six Sigma in the construction industry [45]. The subsequent section elaborates on the hybrid applications.

C. Six Sigma Applications in Construction under Hybrid I

This section discusses the various Six Sigma application categorised under hybrid I.

1) Lean Six Sigma in Construction

Variability in construction is usually caused by equipment break downs, design errors, delayed material and equipment delivery, accidents, environment, labour strikes, change orders and partnership related challenges only to mention a few. Lean Six Sigma (LSS) is the ideal concept to apply as lean approach combats variability but does not eliminate it. In the construction industry Six Sigma identifies problems that are hard to find but easy to fix and lean identify problems that are easy to find but hard to fix.

LSS has been applied to the construction industry by mainly integrating Six Sigma’s DMAIC roadmap with established lean construction processes and setting milestones within the process. Examples of LSS in action in the construction industry have been provided by [7]. LSS can be applied to construction industry to complete project within the stipulated time, cost and quality in order to achieve...
customer satisfaction. The concept should however be given the needed priority by the project team to achieve the required effectiveness.

2). Total Quality Management and Six Sigma in Construction

The acceptance and implementation of Total Quality Management (TQM) has been difficult in the construction industry [21]. The reasons for this is the peculiar nature of the construction industry and its associated implementation challenges given rise to frequent staff mobility, diversity in the design of construction projects, different geographical location of projects, contractual relationships, conventional practices and the long term nature of successful TQM implementation.

The major benefits of TQM have not been achieved in the construction industry [21]. Six Sigma is endowed with the techniques and tools to help TQM achieve success in the construction industry as it focuses on eliminating customer defined defects through variability reduction which eventually leads to internal and external customer satisfaction and organisational improvement [9].

Construction Six Sigma in Total Quality Management (Con6TQM) can be applied to the construction industry by deploying TQM in an entity and applying Six Sigma's DMAIC roadmap with its techniques and tools to individual construction projects within the entity. Hence several Six Sigma projects will be running within an organisation managed with TQM principles. This way the expected long term benefits of TQM can be achieved whereas the short term benefits of Six Sigma can be seen it the individual projects.

3). Green / Sustainability and Six Sigma in Construction

Sustainability has been the order of the day and all organisations are seriously considering its integration in their management processes [52]. The construction industry cannot be exempted as the activities of the industry impacts directly on the environmental, social, and economic pillars of the sustainability concept. It has been argued that the successful application of Six Sigma to the construction industry is very possible with benefits [28][30][34]. Despite these benefits, Six Sigma does not make provision for managing the impact of construction activities on the environment. Construction Green Six Sigma (ConGSS) is capable of bridging this gap.

ConGSS can be applied to the construction industry by integrating the principles of sustainability into the DMAIC road map of a chosen Six Sigma project. This will green improvement and control measures throughout the life cycle of a particular construction project.

4). Kaizen and Six Sigma in Construction

Construction companies have been implementing some continuous improvement strategies that can be traced to kaizen [18]. Some challenges of implementing kaizen in the construction industry are: one off construction projects, on – site nature of construction projects, entrenched traditional practices, lack of management involvement and lack of experts to support kaizen application [18]. Instead of aiming at performance improvement, kaizen is applied on site to correct mistakes and also lacks the system to integrate people into continuous improvement processes.

All these limitations can be over shadowed by merging kaizen with Six Sigma and applying it in construction as Six Sigma can involve management and train experts through its belt system. It can also shift focus from correcting mistakes to continuous performance improvement whiles handling each construction project as a Six Sigma project.

Construction Kaizen in Six Sigma (ConKSS) can be applied to the construction industry by integrating kaizen principles into each phase of Six Sigma’s DMAIC methodology. This is because kaizen can be implemented in activities hence each phase of the DMAIC process can integrate kaizen principles within the activities whereas DMAIC focuses on the overall improvement of the construction project.

5) Supply Chain Management and Six Sigma in Construction

The construction industry is facing some difficulty in managing its supply chains due to the nature of the industry. Hence whereas some argue that Supply Chain Management (SCM) is not ideal for the construction industry [26], others have also suggested that SCM should be merged with other concepts that can provide a disciplined way of integrating processes and coordinating information between parties [12].

Six Sigma can bridge this gap to a considerable extent as it has the strength in controlling process variability and vulnerability, training personnel, sustaining improvement measures, and identifying root cause of problems through metrics. On the other hand, [31] indicates that there is difficulty in implementing the Six Sigma road map throughout the entire supply chain under certain circumstances such as those related to activities in the construction industry.

Construction Six Sigma in Supply Chain (ConSSSC) can be applied to construction in a unique way as there may be several subcontractors and suppliers within a construction project supply chain. [5] suggest a more integrated supply chain based on collaborative agreement between contractors, suppliers and client. Then Six Sigma DMAIC will be integrated into the project supply chain to ensure overall performance improvement. Hence DMAIC will be controlling supply chain management activities within the project.

6). Business Process Management and Six Sigma in Construction

It is believed that Business Process Management (BPM) should be adopted by the construction industry as the business environment in the world keeps changing with the need for prompt and flexible responses such as measuring and collecting real-time data [53]. This is because BPM in the construction industry improves and visualizes process flow whiles sustaining business process improvement of the construction companies [13][53]. A combination of Six Sigma and BPM in the construction industry will produce Construction Six Business Process Management (Con6BPM).

Con6BPM will systematically identify problem areas in relation to critical success factors and also provide the analytical tools to solve complex and difficult business problems whiles easily recognising process flow. To apply Con6BPM in the construction industry, Six Sigma’s DMAIC or DFSS’s DMADV with the belt system
can be integrated into a BPM project. This will improve performance by reducing defects and variability in the business process. This can either be used to improve and existing process or redesign a new one.

7). Human Resource Management and Six Sigma in Construction

The performance of the construction industry largely depends on the management and performance of its human resource [48]. The industry however employs human resource of various levels, skilled and unskilled which requires a strategy to design and improve their effectiveness and productivity through effective supervision management [42]. They argue that there is the need for a strategy to provide the metrics and procedure to manage construction workforce in order to improve performance. Six Sigma can fill this gap with the concept of Construction Six Sigma in Human Resource Management (Con6HRM).

Con6HRM can be applied to construction by making individual construction project Six Sigma project and integrating the belt system into the human resource management of the construction workforce. Hence the existing human resource management system will be improved through the belt system whereas the project will be managed with DMAIC roadmap.

8). Capability Maturity Model and Six Sigma in Construction

Researchers have argued that Capability Maturity Model (CMM) is not applicable to the construction industry as it was not designed for organisations with multiple supply chains [24][8]. Even though according to [24] some researchers have developed a CMM for the construction industry called SPICE, there is the need to find a framework to appropriately address the multiple supply chains in the construction industry.

In view of this, it is premature to integrate present form CMM and Six Sigma in the construction industry. Hence it is recommended that further studied be carried out to ascertain this assertion.

9). Theory of Constraint and Six Sigma in Construction

It has been argued that constraints in construction projects have placed a limitation on their performance improvement [16]. In view of this some have suggested the application of Theory of Constraint (TOC) in the construction industry in order to enhance performance improvement [32][47]. The multi –party working nature of the construction industry can lead to serious conflicts and hence the need to prioritise constraints to be addressed. TOC and Six Sigma blend well in construction projects.

Construction Six Sigma in Theory of Constraint (Con6TOC) will aid in identifying constrained areas leading to Six Sigma project selection which will limit the high cost associated with implementing improvement strategies anywhere. The belt system in Six Sigma can also be used to provide the required experts to deploy TOC in the construction industry.

Con6TOC can be applied to the construction industry by first deploying TOC together with Six Sigma’s belt system to identify the constraint then DMAIC problem solving approach used to identify and eliminate the root cause of problems.

10). ISO 9001 and Six Sigma in Construction

ISO 9001 was issued by International Organisation for Standardisation (ISO) with generic documents outlining the minimum requirements for quality systems of organisation in all industries [46]. The construction industry has embraced these quality standards ranking third among the industrial worldwide certification [15]. In the construction industry quality management means satisfying the client’s requirements and expectation which covers not only the quality of the finished product but also the approach used to meet defined requirements of the client [15]. Six Sigma aids the construction industry to measure up to quality management. Six Sigma and ISO 9001 are easy to merge and enhance each other’s performance. For instance, ISO9001 has clauses to support Six Sigma structured approach to continuous improvement [35].

Construction Six Sigma in ISO9001 (Con6ISO9001) can be applied to the construction industry by following DMAIC road map in managing the construction project whereas ensuring that the standards set by ISO9001 are met or exceeded where ever is applicable. Hence Six Sigma projects are sure to meet the standards of ISO9001.

D. Six Sigma Applications in Construction under Hybrid II

This section provides a brief overview of Six Sigma applications that are based on three concepts. The applications are: Supply Chain Management, Radio Frequency Identification, and Six Sigma; Enterprise Resource Planning (ERP), Lean, and Six Sigma; Design for Six Sigma, Lean, and Six Sigma; Lean, Total Quality Management, and Six Sigma; ISO 9001, Lean, and Six Sigma; Lean, Six Sigma, and Project Management.

1). Supply Chain Management, Radio Frequency Identification, and Six Sigma

Radio Frequency Identification (RFID) is a technology that utilizes radio waves to automatically identifying individual items with the aim of tracking items in the supply chain without requiring the line of site by mostly storing the serial number of the item [54]. Integrating Six Sigma and construction supply chain management will improve performance by reducing cost [31], combining it with RFID will create an added advantage of identifying the location of items in the supply chain easily and quickly without physically seeing them.

2). Enterprise Resource Planning, Lean, and Six Sigma

Enterprise systems are configurable information system packages that are able to integrate various functions of an organisation and information to be shared across units, departments, and functional areas within an organisation leading to synergy and allowing the right peoples within the organisation to have access to information at the right time [25]. When this approach is integrated with construction Lean Six Sigma, the hybrid will provide an approach that reduces waste, defect and variability whiles making available information on activities and units within the organisation to the right people and at the right time.

3). Design for Six Sigma, Lean, and Six Sigma

The three concepts Design for Six Sigma, Six Sigma, and
Lean when integrated will reduce waste, defects and variability [11]. It will also make it easier for the construction industry to achieve Six Sigma quality level as designs will be focusing on that.

4). Lean, Green, and Six Sigma

Sustainability is currently driven by governmental and international regulations [27]. After adoption of Agenda 21 and The Kyoto Protocol in 1997 to enhance sustainability, the green building movement in USA was formed to extend sustainability into building practice [52]. Since then the construction industry has embraced practices that will result in a sustainable facility within the life cycle of any structure. The setback in LSS is that it cannot determine the impact of construction activities on the environment hence the need to integrate LSS with green [1]. Integrating Six Sigma and Lean provides an approach that benefits from capitalising on the strengths of the individual approaches and over shadowing their weaknesses. Thus waste and customer perceived defects are reduced or eliminated. Merging this with green concept in construction will ensure that the waste and defect reduction or elimination is done in a way that will allow people to have the full benefits of the environment today and in the future [1][2].

Focusing on construction waste, it has been argued that lean and green can identify waste and evaluate their impact on the environment then Six Sigma will determine the method to use to eliminate the waste [2]. After developing a model called Lean, Green, Six Sigma (LG6) by integrating lean and green thinking into each step of the DMAIC roadmap, [2] tested the model by applying it to identify and manage waste in the processes prior to the construction phase of a pile cap driving process. The result was an improvement in environmental impact and reduced cost. LSS and green is therefore applicable to the construction industry to improve project performance and environmental impact.

5). Lean, Total Quality Management, and Six Sigma

Even though the three concepts have many similarities, construction industry will gain if it deploys a combination of the three concepts. It is believed that Six Sigma and Lean can be combined to provide an excellent roadmap used to strengthen TQM values in an organization [38].

6). ISO 9001, Lean, and Six Sigma

Some researchers have proposed ISO 9001 standard based quality management system by designing a framework that integrates Lean Six Sigma and DMAIC methodology as well as belt based training infrastructure [43]. This management system will help the construction industry to implement a Lean Six Sigma programme with minimum effort and expenditure.

7). Lean, Six Sigma, and Project Management

Lean Six Sigma has been identified as the most popular Six Sigma hybrid suggesting its integration with the stake holder analysis aspect of project management [44]. The methodology is likely to be successful in the construction industry as it makes stakeholder management the key element for the success of any LSS project easier.

III. METHODOLOGY

The research targeted peer-reviewed journals on Six Sigma and its new trends published over the past decade. It also used information from editorials, conference papers, masters and doctoral thesis where necessary. A total of 54 articles were reviewed for the research. The literature contributions were obtained primarily from research databases including Emerald Insight, Science Direct (Elsevier), Research Gate, Google Scholar, Francis and Taylor and other internet sources. The initial descriptors used for the search were “new Six Sigma trends,” “trends in Six Sigma,” “Six Sigma and construction industry.” Each article was reviewed in order to eliminate the articles not related to performance improvement. The various Six Sigma applications were identified from reviewing the articles most of which were recommendations for future research. The concepts that formulated the identified applications were then searched individually and then combined with “construction industry,” as well as with “Six Sigma and construction industry.” The resulting articles from the combined search were further reviewed and critically analysed to highlight the existence of trends, applications and any categorisation.

IV. FINDINGS AND DISCUSSION

The findings of the research are presented in table II Out of the 54 articles reviewed, 77% stated applications under hybrid I, 15% under off-shoot and 8% under hybrid II. 60% of applications under hybrid I were published after 2010 whereas 70% of those under hybrid II and 25% under off-shoot were published within that time. 100% of off-shoot and hybrid II are applicable in construction whereas 90% of hybrid I can be applied to construction. There was evidence of 100% practical use of applications under off-shoot, 10% under hybrid I and 14% under hybrid II.

The most popular application was identified under hybrid I, namely Lean Six Sigma because it appeared in almost all the literature on trends and forms part of 6 applications under hybrid II, whereas the latest application was identified under hybrid II namely Lean Six Sigma and Project Management.

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It has become clear from the review of literature that 17 applications out of the 18 identified are applicable to the construction industry as performance improvement strategies. One application, namely Six Sigma and Capability Maturity Model has been determined not to be applicable to the
construction industry at the moment. 3 of the applications have evidence of practical application in literature. They are Lean Six Sigma, Lean, Green, and Six Sigma, and DFSS. The anticipated opportunities related to each of the remaining 14 applications will be discussed.

**A. Opportunities related to 8 Six Sigma Applications under Hybrid I in the Construction Industry**

The following section discusses opportunities related to various Six Sigma applications in the construction industry.

1) **Total Quality Management and Six Sigma in Construction**

Con6TQM when applied in the construction industry will give the industry the opportunity to improve its performance through:

- Identifying root cause of problems which when eliminated will prevent the re-occurrence of the problems.
- Satisfying internal and external customers by eliminating customer defined defects.
- Providing the metrics to measure the performance of construction projects.
- Reducing cost and improving profitability.
- Improving overall management performance.

2) **Green / Sustainability and Six Sigma in Construction**

Projects managed with ConGSS concept will provide the construction industry the opportunity of:

- Reducing negative environmental impacts of construction activities by identifying the root cause of green problems.
- Creating awareness on sustainability in the usage of the completed facility and hence reducing the negative usage impact on the environment.
- Reducing the life cycle cost of the facility.
- Improving the health and safety of those who use the facility.
- Providing the metric to determine green performance improvement and contributing to the achievement of the millennium development goals.
- Eliminating green customer defined defects through variability reduction and hence satisfying internal and external customers.
- Enhancing the efficiency in the construction and usage of the facility thereby improving the overall performance of the construction project and the organisation undertaking the project.

3) **Kaizen and Six Sigma in Construction**

The application of ConKSS in the construction industry is likely to open up opportunities such as:

- Variability reduction in construction processes through the elimination of root cause of problems.
- Improved efficiency which leads to cost reduction as Six Sigma reduces waste and kaizen speeds up processes.
- Training of experts and achieving management involvement and support through the belt system.
- Maintaining cultural change through the feedback from DMAIC control step.
- Increased internal and external customer satisfaction.
- Improved overall project performance with the metrics to measure the performance level.

4) **Supply Chain Management and Six Sigma in Construction**

When ConSSSC is deployed in the construction industry it may benefit from the following opportunities:

- Reduction of process variability within the project supply chain due to defects identification and elimination.
- Trained personnel to manage the supply chain to increase efficiency.
- Metric to measure performance and sustain improvement measures.
- Internal and external customer satisfaction resulting in competitive advantage.
- Produces a more disciplined supply chain project.

5) **Business Process Management and Six Sigma in Construction**

The construction industry will have the following opportunities when Con6BPM is applied:

- Easy identification of process flow to enhance the identification of root cause of problems.
- Reduce process variability and sustain improvement measures.
- Sustained internal and external customer satisfaction through sustained defect elimination.

6) **Human Resource Management and Six Sigma in Construction**

Applying Con6HRM to construction projects would make the construction industry realise the opportunities bellow.

- Improve internal and external customer satisfaction closely linked to the accepted organisational strategic goal.
- Unsere improvement processes are wholly supported by the human resource unit of the construction project.
- Metrics to measure and evaluate performance improvement of a project including the role played by the human resource unit.
- Disciplined management approach supported by well trained personnel.

7) **Theory of Constraint and Six Sigma in Construction**

Applying Con6TOC will open up the following opportunities in the construction industry.

- Cost reduction due to direct focus on problem areas.
- Easy application of TOC due to support and training by belt system.
- Aligning problem solving approach to overall organisational goal.
- Internal and external customer satisfaction

8) **ISO 9001 and Six Sigma in Construction**

Applying Con6ISO9001 will open up the following opportunities in the construction industry.

- Improve internal and external customer satisfaction closely linked to the accepted worldwide quality standards.
The opportunities related to Six Sigma applications under hybrid II will be generalised as most of the opportunities have been stated in the above sections. The anticipated opportunities for the construction industry border along:

- Defect elimination and variability reduction.
- Internal and external customer satisfaction.
- Performance improvement tied to organisation goals.
- Metrics for measuring and evaluating performance improvement.
- Experts through education and training by the belt system.

V. CONCLUSION AND FUTURE RESEARCH

The construction industry is saddled with persistent poor performance. The deployment of Six Sigma and its different applications have been suggested as an efficient way of addressing this challenge. This research has identified 18 Six Sigma applications categorized under the three Six Sigma trends namely Six Sigma off-shoot, Six Sigma hybrid I, and Six Sigma Hybrid II. The review concludes that these applications can be deployed in the construction industry as performance improvement strategies except one application under hybrid I, namely, Six Sigma and Capability Maturity Model.

It is recommended that future research explores the application of Six Sigma and its new trends in a specific project delivery method to ascertain its effectiveness. Further research should also be conducted to explore the possibility of merging Six Sigma and Capability Maturity Model to verify the current conclusion.

REFERENCES


