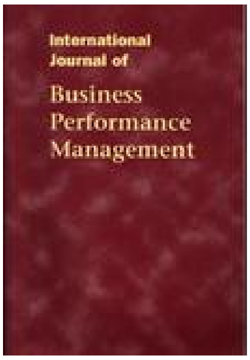


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# Development of a conceptual benchmarking framework for the construction industry

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# Development of a conceptual benchmarking framework for the construction industry

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**Abstract:** Existing benchmarking frameworks and performance measurement tools are not suitable for the construction industry due to the industry's peculiarities. This paper explores the development of a dedicated benchmarking framework for the construction industry which can be used by construction firms to benchmark their performance against the performance of global leaders. Existing benchmarking frameworks and global performance ranking models identified from literature were reviewed. The strengths and weaknesses of the frameworks and models were identified and have been adapted in developing the benchmarking framework dedicated to the construction industry. The framework was tested using validation interviews with four international construction industry experts and later through an online survey of construction professionals. The benchmarking framework in this paper is the first such framework dedicated to the construction industry. It provides a simple, cost-effective approach to benchmarking that construction firms, including those with little to no benchmarking experience can use.

**Keywords:** benchmarking; benchmarking framework; performance measurement; performance improvement.

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**Biographical notes:** Joseph Kwame Ofori-Kuragu is a Senior Lecturer at Anglia Ruskin University, UK, where he teaches a range of Construction Project Management courses. His research focuses on the future of construction and on transforming construction. His areas of specific research interest includes construction productivity, industry development and improvement, modern methods of construction (MMC), 3D printing, innovation and public private partnerships (PPPs).

## 1 Introduction

Improvements in processes and advances in technology mean that construction firms can undertake projects with increasing sophistication, better manage project costs, and better meet customers' needs, leading to increased organisational and project success. Despite the increasing sophistication and excellence within the industry, the performance of construction firms in comparison with global best-in-class organisations on global performance rankings such as the Forbes 2000, Fortune 500 listings, or the FTSE Index is low. So, why are construction firms unable to compete in their financial performance with global leaders? Benchmarking is seen as a catalyst for improvement (Anand and Kodali, 2008) which helps to increase efficiency and improve profitability and offers opportunities for improving performance (Cook, 1995). For the construction industry to derive optimum benefits from benchmarking, the industry needs to move away from intra-industry comparisons and embrace inter-industry comparisons with best-in-class organisations in other industries. This will expose any gaps in the performance of construction firms and enable them to identify and adopt the best practices from the best-in-class organisations for their operations (Flynn et al., 1999). However, there is a gap in construction industry-specific methods of undertaking such comparisons.

This paper explores the development of a benchmarking framework for construction firms that can be used to undertake comparisons with global best-in-class organisations. The conceptual model will enable cross-industry comparisons by construction firms and also enhance value judgments by decision-makers in the construction industry and enable quicker decisions leading to overall improved financial performance. Different types of benchmarking and approaches to benchmarking have been reviewed with a discussion of how to identify what to benchmark.

## 2 Literature review

### *2.1 The need for improvements*

The construction industries in many countries, compared with other industries, have over the past 50 years shown rather small improvements in productivity with slow rates of innovation and innovation adoption (Durdyev and Ismail, 2019; Jaillon and Poon, 2010). The lack of innovation and delayed adoption within the construction industry of new and emerging technologies as compared to others is caused by a lack of investment in research and development (R&D) which is the lifeblood of any industry (Farmer, 2016). A lack of investment in IT and in research and development (R&D) are the biggest barriers to innovation by construction companies (MGI, 2017; MBI (2010). The industry is characterised by ad-hoc processes insufficient knowledge transfer from one project to another, weak project monitoring, low collaboration with suppliers, and a lack of people development, according to WEF (2016).

In the era of Industry 4.0, the farmer review argues that the global construction industry has in many respects not even made the transition to ‘Industry 3.0’ status which is based on the large-scale use of electronics and IT to automate production (Farmer, 2016). This much-needed shift toward cutting-edge construction technology will enhance profitability, safety, and predictability (Gray, 2016). Despite the increasing sophistication and excellence within the industry, the performance of construction firms in comparison with global best-in-class organisations on global performance rankings such as the Forbes 2000 and Fortune 500 listings is low. In 2022, there were just two construction firms in the top 100 firms featured in the Forbes 2000 (Forbes, 2022) despite steady improvements in performance across the construction industry in the UK (Construction Excellence, 2009). So why are construction firms unable to compete in areas such as financial performance with global leaders? To address the question of why construction firms underperform leading firms from other sectors, numerous comparisons have been made between the construction industry and the automobile industry with suggestions that the construction industry learns from the experience of the automobile industry (Cho et al., 2011) using benchmarking as a catalyst for improvement (Anand and Kodali, 2008).

## 2.2 Definition of benchmarking

RICS (2020) describes benchmarking as a strategic tool that enables users to make decisions that improve asset effectiveness and efficiency. This improves the outcomes of infrastructure projects in social, environmental, and economic terms ensuring that investments in the infrastructure sector are effective. It is 'the continuous process of measuring products, services, and practices against a company's toughest competitors or those companies renowned as industry leaders' (Camp, 1989). It is the activity of learning, exchanging, and adopting best practices in an organisation (Camp, 1995) and means constantly emulating the best to introduce change and aspiring for superior performance standards (Zairi, 1994). For organisations that seek to attain world-class performance, benchmarking helps to identify what is possible and how it is done (Deros et al., 2006). Benchmarking is the 'preferred method for improving performance' (Camp, 1989), and for achieving world-class performance (Moullin, 2004).

Benchmarking has been identified as being able to help organisations to identify areas, systems, or processes for continuous improvements for dramatic business process reengineering (ASQ, 2023).

Benchmarking in the context of construction and infrastructure project delivery involves comparing projected, or actual, project performance information against similar information from past projects with the aim of improving assurance and delivery (Beatham et al., 2004). As part of the process, the historical information from past projects and programmes is analysed to create a point of reference which can then be used to compare observed or predicted details of a particular project (IPA, 2021). Sammut-Bonnici (2015) defined benchmarking as the comparison of services, products, and processes across different sections of an organisation that carry out similar operations, among competitors from the same industry sector, or among companies that have similar processes across different industries. (Ettorchi-Tardy et al., 2012). It provides opportunities to compare construction production costs with competitors.

This paper adopts a working definition of benchmarking as 'the pursuit by construction and infrastructure organisations of enhanced performance through learning from, adapting and exchanging the best industry practices using a continuous process of measuring products, services, practices, processes and emulating the successful practices of the best companies' (Camp, 1989).

Benchmarking for infrastructure projects helps improve project development and decision-making through the use of data from other projects. Inaccurate capital and lifecycle costs and expected benefits for projects can result in unrealistic expectations and a failure to deliver expected project outcomes. It is very helpful at the start of the project process where wrong or ill-informed choices can seriously affect a project's chance of success and also across the project lifecycle (IPA, 2021). It enables construction and infrastructure organisations to compare their performance with the best-in-class in the sector. The process allows an understanding of how the best-in-class attain excellence to be gained whilst enabling organisations seeking to improve their performance to strategise and set objectives for the future (Erdil and Erbıyık, 2019).

## 2.3 Benchmarking types

Two main approaches to formal benchmarking are identified as performance benchmarking and best practice benchmarking (also identified as process benchmarking). Best Practice Benchmarking Best practice benchmarking is described as a more mature approach to benchmarking (Jetmarová, 2011). ASQ (2023) identified two main types of benchmarking technical and competitive benchmarking. Sammut – Camp (1989), the seminal work on benchmarking chose four main types of benchmarking – internal, competitor, industry, and generic benchmarking. Generic benchmarking, also described as world-class benchmarking involves 'looking beyond country borders in different geographical locations (Anand and Kodali, 2008), to the recognised industry leader which performs better than any other in a particular metric' (Chang and Kelly, 1994). Whilst Jetmarová (2011) evaluates the diversity in the classification of benchmarking types and suggests a lack of consensus in the classifications by the different authors, a closer examination shows some broad agreements in parts of the Camp (1989), Chang and Kelly (1994), Sammut- Camp (1989), and Anand and Kodali (2008). It is recommended that a more beneficial approach for construction firms will be to look beyond the industry to undertake world-class benchmarking which involves comparisons with leading global performers. The two methods recommended by RICS (2020) for the infrastructure sector: the input, output, performance, and outcome (IOPO) method and the system, network, asset, and project (SNAP) can be adapted to the world-class benchmarking approach.

## 2.4 Problems with benchmarking

Amongst the constraints to benchmarking implementation, time is the greatest (Hinton et al., 2000). It has been shown that benchmarking costs can outweigh the benefits (Lincoln and Price, 1996). Most of the existing frameworks are based on large company structures and are thus unsuitable for SMEs (Deros et al., 2006). In the past, large organisations and subsidiaries of large organisations are those most likely to have been involved in benchmarking (Holloway et al. 1997). Hinton et al. (2000) concluded that substantial benchmarking activity was 'results' benchmarking as opposed to 'process' benchmarking. The benchmarking framework developed in this paper will enable both processes and results benchmarking. Whilst increasing numbers have previously implemented benchmarking programmes (Jarrar and Zairi, 2001), evidence of its effectiveness is scant (Holloway and Francis, 2007). This has led to some questioning the justification for the continued use of benchmarking in the construction industry.

The apparent lack of success in benchmarking in the construction sector has been attributed to a lack of construction-specific methods of benchmarking (Mohammed 2006). 'Models customised for particular industries may not easily lend themselves to easy adaptation to other sectors' (Anand and Kodali, 2008). With the peculiar nature of the construction industry, its one-of-a-kind projects (The Construction Task Force 1998), and the frequency of incomplete or non-existent data (Mohammed, 1996), the 'one-size-fits-all' approach to benchmarking does not yield optimum benefits to the construction industry.

Winch (2003) challenges widespread perceptions of poor performance of the construction industry compared with other industrial sectors by challenging the systems used in the classification of performance data. Winch (2003) questions the appropriateness of the continued use of the automobile industry based on its apparent superior performance as a benchmark for the construction industry. Whilst there is merit in Winch (2003)'s position, profitability as the fundamental bottom line of businesses in all industries also shows that the construction industry lags behind many other industries. Irrespective of the structural differences with other industries, strategies used to improve profits in other industries may be emulated by benchmarking against the best-in-class from leading industries.

### *2.5 Review of benchmarking frameworks*

In developing the conceptual benchmarking model in this paper, the processes used in existing benchmarking models were analysed. In this section, existing benchmarking frameworks are reviewed to establish the main steps involved in the benchmarking processes for most of the existing benchmarking models. The most common steps are adapted for use in the Benchmarking Model. Amongst the frameworks reviewed were the Deros et al. (2006) benchmarking framework, Camp's (1989) Xerox benchmarking model, the Anand and Kodali (2008) model, Spendolini's (1992) framework, the Voss et al. (1994) model, Fong et al. (2001)'s benchmarking framework and the Zairi (1994) model the Friday-Stroud and Sutterfield (2007) model, the Baldridge award model, the EFQM model, and the Bassioni et al. (2008) Model.

### *2.6 Shortcomings of existing performance comparison and benchmarking models*

The Fong et al.(2001) benchmarking framework is one of the more popular frameworks reviewed but its value is limited because the number of CSFs provided is not sufficient to enable organisations with little experience in benchmarking to effectively use the framework. The Deros et al. (2006) benchmarking framework for automotive small and medium enterprises (SMEs) appears more suited to the manufacturing sector. This reduces its suitability for the construction industry as a whole. The Spendolini (1992) model based on a five-stage process is heavily dependent on benchmarking partners and other third-party sources such as employees of benchmarked organisations, consultants, analysts, industry reports, and computerised databases. It is thus difficult to access and expensive.

The Voss et al. (1994) model involves a complex 'top-down' approach to developing an overall framework, and a 'bottom-up' approach to identify sub-processes and characteristics of best practices. The Voss approach also requires a thorough understanding of how to develop a benchmarking framework and the tools required for using these and thus is not suitable in cases where there is little or no understanding of the benchmarking process.

Fortune 500 is an annual ranking of the USA based firms based on revenue data. It can be used by construction firms to benchmark their performance against the biggest US companies by comparing turnover. However, the use of turnover as the only metric can give a false impression about corporate size (Zairi, 1994). Forbes Global 2000 uses a composite set of four metrics with equal weighting: sales, profits, assets, and market value (Forbes, 2022). The Forbes 2000 listing goes a step further than the Fortune 500 listing with an increased number of metrics. However, like Fortune 500, Forbes Global, 2000 lacks a clearly identified hierarchical structure that can be used by construction firms to benchmark their performance.

The EFQM excellence model is one of the most popular performance measurement tools in Europe (EFQM, 2010) and is particularly relevant to the construction industry (Oakland and Morosszeky, 2006). The Baldridge Award framework provides one of the most successful uses of benchmarking (Voss et al., 1994). The Baldridge Award, the EFQM excellence model, and the Deming awards are criticised as being too expensive to implement and not suited to small construction firms (Gbobadian and Woo, 1996). Bassioni et al. (2008)'s model adapts the EFQM to construction 'however limited attention to measures of organisational success detracts from its value. Ofori-Kuragu and Baiden (2008) created a benchmarking framework for Ghanaian contractors. The framework however can be complex to use, especially for small construction firms. The review of the existing benchmarking frameworks provides insight into what works and what does not. These lessons have informed the process of developing the framework in this paper.

RICS (2020) argues that benchmarking should be a proactive process of continuous engagement with similar organisations as a means to identify transferable best practices. The involvement of an entity is also argued to be a good approach (Iseal Alliance, 2019). However, in this paper, it has been acknowledged that it is not always possible to have access to best-in-class performers or leading entities willing to share their experiences. The framework developed in this paper thus allows for benchmarking to proceed with or without the active participation of an identified best-in-class entity, enabling a focus on their practices instead.

### *2.7 Development of benchmarking steps*

In this section, existing benchmarking frameworks have been reviewed and the stages used in these frameworks identified to help identify the stages to be used in the benchmarking framework to be used for construction firms.

Voss et al. (1994) proposed six stages for benchmarking frameworks as follows: identify the business process to be benchmarked, use a 'top-down' approach to develop an overall framework of the processes to be benchmarked, use a 'bottom-up' approach, based on literature and knowledge of best practices to identify sub-processes and characteristics of best practice, develop metrics for each process, develop tools, self-assessment scorecards, and benchmarking frameworks and test the frameworks and tools for usability and usefulness. Voss et al. (1994) suggested that any process, tool, or model for benchmarking should pay attention to its use for self-assessment and that self-assessment should precede benchmarking.

Anand and Kodali (2008) used the Xerox benchmarking model (Camp 1989) to identify the best practices used in benchmarking. 35 benchmarking models were benchmarked against the original benchmarking model developed by Xerox leading to the development of a 12-step benchmarking model as outlined as follows:

1 team formation

2 subject identification

3 customer validation
4 secure management commitment,
5 identification/measurement of csfs and performance measures/indicators
6 select partners
7 pre-benchmarking activities
8 benchmarking
9 gap analysis
10 action plans
11 implementation
12 continuous improvement.

The Anand and Kodali (2008) model compare with the Xerox model as follows:

1 identify the benchmarking subject
2 identify the benchmarking partners
3 determine data collection method
4 determine current competitive gap
5 project future performance
6 communicate findings and gain acceptance
7 establish functional goals
8. develop action plans
9 implement action plans
10 recalibrate the benchmark.

Both the Anand and Kodali (2008) and Xerox models are dependent on the involvement of a ‘benchmarking partner which is one of the main problems associated with benchmarking programmes (Hinton et al., 2000). The problem affects smaller contractors the most since the potential for reciprocal benefits to the benchmarking partner is minimal and thus provides little motivation for the more successful partners to engage.

Spendolini (1992) developed a simple five-stage benchmarking process as follows: determine what to benchmark, form a benchmarking team, identify suitable benchmarking partners, collect and analyse benchmarking information, and act. Whilst the Spendolini (1992) model has fewer steps than most of the others, it covers most of the steps which are common to the other models.

The Malaysian Benchmarking Service, NPC (1999) framework is outlined as follows:

1 agree on benchmarking topic
2 finalise on scope: measures and definition
3 data collection survey

4 share strengths
5 site visit
6 data collection site visit
7 share findings
8 planning for adopting best practices
9 implementation of best practices
10 monitoring of results
11 standardisation
12 daily control.

Zairi (1994) identified two stages involved in the benchmarking processes referred to as the effectiveness and competitiveness stages respectively. The effectiveness stage relates to the internal processes of the organisation whilst stage two relates to improving competitiveness. The competitiveness stage of the Zairi (1994) framework is made up of nine steps as follows:

1 select a process suitable for benchmarking
2 identify suitable partners
3 agree on measurement strategy
4 compare standards
5 understanding why the difference in performance
6 change relevant practices for improving performance
7 compare standards
8 repeat experience with same/new partners regularly
9 apply benchmarking to all processes.

Fong et al. (2001) developed a framework for benchmarking the Value Management process. Fong et al. (2001) identified eight stages common to benchmarking:

1 deciding what to benchmark
2 understanding your performance
3 identifying the best performers for comparisons including direct competitors, best-in-class organisations, or the best performers in internal functional areas
4 collect and analyse data
5 determine current performance levels and project future performance levels
6 gain acceptance and establish functional goals
7 develop action plans and implement the best practices
8 monitor progress and re-calibrate the benchmark measures.

The IPA (2021) benchmarking methodology guidance includes seven steps as follows:

1 confirm the project objectives and set the metrics

2 break the project up into major components for benchmarking

3 develop templates for data gathering

4 scope sources and gather data

5 validate and re-base data

6 produce and test the benchmark figure

7 review and repeat, if necessary, before using data for benchmarking.

Whilst this has simple easy to implement steps, the emphasis on projects and on project cost benchmarks limits the scope of applicability to other aspects of the industry and organisational development.

Apart from minor variations, there is generally consistency amongst the key processes involved in the different benchmarking frameworks reviewed in this study.

## *2.8 Identifying what to benchmark*

The first step to identifying what to benchmark is to develop a clear mission statement and the typical outputs expected by clients and customers. One of two broad approaches may be used – benchmarking practices critical success factors (CSFs) starting in all cases with an investigation of the best industry practices (Camp, 1989).

## *2.9 Critical success factors*

CSFs may be defined as the actions that an ‘organisation must accomplish to achieve its mission (Oakland and Marosszeky, 2006). With managements inundated with lots of data and the need for selectivity, CSFs help to filter out extraneous data coming through to management (Bond, 1999). They are enablers that when put into practice will enhance the prospects for learning from best-practice organisations (Deros et al., 2006). With the attainment of excellence in CSFs linked to performance excellence, CSFs are very useful for managers and decision-makers (Kasul and Motwani, 1994).

Rockart (1982) was the first to propose the approach of determining CSFs as an established method that can be used for undertaking organisational analysis. CSFs can be defined as the factors which managers need to monitor closely to ensure the successful delivery of projects and provide a means of identifying the essential elements which need to be addressed for organisations to implement change more effectively. They represent a set of very important issues on which organisations have to focus their limited resources on in the pursuit of success (Rockart, 1982). They are the inputs into the management system of an organisation that directly results in the success of projects (Koutsikouri et al., 2008). Identifying the key factors responsible for the success of construction projects enables limited resources to be allocated appropriately to projects (Chua et al., 1999) demonstrating how significant CSFs are to project success. CSFs differ from one country to another and change in response to changes in policy and industry changes. Despite extensive studies undertaken on CSFs, much of the existing work is very general and in the few examples done within specific country contexts, these were largely context-specific making it difficult to apply them in other countries (Yong and Mustafa, 2013). Whilst there are some groups of CSFs developed for segments of the construction industry, there must be an ambitious effort for the construction industry to benchmark against emerging technologies and solutions which are increasingly being used by leading industries.

BEC (2014) explores a benchmarking system used by construction firms in Denmark. A set of seven KPIs are used to benchmark contractor performance for Danish contractors. These are actual construction time about planned construction time, several defects entered in the handing-over protocol, classified according to the degree of severity Economic value of defects, defects in delivery that hamper the intended use of the essential parts of the building, accident frequency, customer satisfaction with the construction process and customer loyalty.

The Construction Industry Institute (CII) of the USA uses an online benchmarking system. The online Performance Assessment System provides a means for members of construction firms to compare their performance on both capital and maintenance projects with the 'best in class.' The CII benchmarking system has 4 main KPI areas for measuring performance as follows: Performance, Construction Productivity, Engineering Productivity, and Practices (CII, 2012). The CII (2012) KPIs have fewer categories of measures than most of the others (Ofori-Kuragu et al., 2016).

## *2.10 Performance measures and performance indicators*

A 'performance measure' is a metric that is used for quantifying the efficiency and effectiveness of action (Sousa et al., 2006). Performance measures provide a mechanism for a related product or process improvement policies developed by senior management to action at a local organisational level (Bond, 1999). Performance indicators are absolute measures of performance recorded by organisations as against perception measures obtained directly from service users. Both 'measures' and 'indicators' help to quantify input, output, and performance dimensions. They may be simple or composite (BNQP, 2009). BNQP (2008) does not distinguish between 'measures and indicators' describing both as numerical information used to quantify the input, output, and performance dimensions of processes, products, programmes, projects, services, and the overall outcomes of an organisation (KPI Working Group, 2000). Whilst most studies use the more popular measure, key performance indicators (KPIs), this paper introduces a composite measure, key performance measures and indicators (KPMIs) (Peterson et al., 1999). Deriving from the definitions of performance measures and performance indicators respectively, KPMIs can be described as short-term composite measures which can be used to measure the effectiveness and efficiency of operations and a superior measure to either performance measures or performance indicators on their own (Bou-Lluslar et al., 2005).

## *2.11 Benchmarks for excellence*

Egan's rethinking construction report described the levels of performance achieved by the best organisations in key performance areas. Amongst the best companies, average reductions of between 6% and 14% in capital cost year on year with the highest being a 40% reduction year-on-year are achievable. Such companies are regularly able to achieve a 10%–15% reduction in construction time, 20% increases on average in the number of projects completed on time, and cost and predictability rates regularly exceeding 95% (The Construction Task Force, 1998). World-class organisations are also able to achieve a minimum 30% annual reduction in project time zero defects, 50%–60% reductions in accident rates in two years or less, 10% to 15% gains in productivity per year, and 10% to 20% increases in turnover and profits year on year and 65% decrease in absenteeism (The Construction Task Force, 1998). These present realistic benchmarks for construction firms aiming for excellence to target.

The construction sector deal of the industrial strategy provides the framework for developing a construction sector in the UK that delivers a 33% reduction in the cost of construction and the whole life cost of assets (BIS, 2013) whilst the UK's Construction Strategy proposes a 50% reduction in the time taken from inception to completion of new build, a 50% reduction in greenhouse gas emissions in the built environment and a 50% reduction in the trade gap between total exports and total imports of construction products and materials (CIC, 2013). The adoption of digital and manufacturing technologies can result in productivity gains of between 50 and 60% (MGI, 2017). The productivity increases arise from a transition to new business models which emphasise collaboration in addition to more efficient and better-integrated supply chain management practices.

## *2.12 Approach to study*

In developing this paper, a thorough review of literature on benchmarking, benchmarking frameworks, and other performance measurement tools was undertaken. Their features, modes of use, processes involved, inputs, and other characteristic features were reviewed. The strengths and weaknesses of the existing frameworks and performance measurement tools were identified. Based on the lessons learned from the existing benchmarking frameworks and performance measurement tools, a benchmarking framework was developed in this paper for the construction industry. The framework addresses the perceived weaknesses in existing models.

To test the usability and functionality of the developed framework, a panel of four international experts was asked to review the framework and provide feedback. Four expert interviews were conducted with selected experts drawn from the construction industry including two leading academics, a director of a research institute, and an expert on benchmarking to review the benchmarking framework. Interviews were conducted using semi-structured questionnaires. The questionnaire was designed to mainly assess the effectiveness and usability of the framework.

The experts were asked for their views on the simplicity of the respective tools, the terminology used, how easy the tools were to use, the potential contribution the respective tools could make to the benchmarking process in a construction firm, and to what extent they thought the tools could improve performance. Respondents were asked to identify any observed weaknesses of the respective tools and make recommendations for improving the benchmarking framework for contractors. After reviewing the framework, the experts provided feedback which was used to revise and further refine the framework.

The feedback from the evaluation of the framework by the panel of four industry experts was used to refine and improve aspects of the framework. Following these refinements, a second round of validation was organised through an online survey of industry professionals. This survey was undertaken using structured questionnaires developed from modified versions of the questionnaires used with the panel of experts. To enable a broad range of industry professionals from different backgrounds and experiences to take part in the survey within the constraints of time, questionnaires were sent via email originally and through social media platforms with prospective participants and respondents were encouraged to share with their contacts. Respondents included a broad range of industry professionals including project managers, construction firm owners, quantity surveyors, architects, etc.

## 3 Results

### *3.1 Feedback from expert interviews*

This section presents a summary of the outcomes of the interviews held with the four experts after they had reviewed the original version of the framework developed. From the analysis of the interview responses, two of the four experts interviewed agreed that the benchmarking framework developed was simple to use with one choosing 'strongly agree' and one taking a neutral stance. On the terminology used in the framework, three agreed that they were easy to understand whilst one disagreed. On how easy the benchmarking framework developed in this paper was to use, all four experts agreed that it was easy to use. Two agreed that it simplified the benchmarking process with the other two in strong agreement. On 'whether the tool could help improve performance', one of the experts disagreed whilst two agreed and the last expert strongly agreed with the suggestion. Most of the additional suggestions were related to the 'terminology' used in the framework. All four respondents agreed that some of the terms used in the framework may not be easily understood, especially by small construction firms. This problem has been addressed by replacing difficult words with simpler terms.

Other specific comments related to the presentation of the framework. There was a suggestion that the provision of a list of CSFs in the original version of the framework made the framework quite prescriptive given that priorities would differ in different settings. The examples of CSFs included in the draft framework have been taken out altogether in the final version of the framework presented in this paper in response to feedback from the evaluation by the experts.

### *3.2 Results of validation survey for benchmarking framework*

Respondents were asked to assess the ease of use, usability, and readiness to use the questionnaires. 79 completed questionnaires were returned. Using a Likert scale of 1 to 5 where 1 meant 'strongly disagree', 2 meant 'disagree', 3 meant 'neutral', 4 meant 'agree' and 5 representing 'strongly agree'. The survey results were analysed qualitatively using coded responses.

The results of the validation survey are shown in Table 1. The responses were coded with the answer options 1 to 5 on the Likert scale representing 'strongly disagree', 'disagree', 'neutral', 'agree' and 'strongly agree' coded as –2, –1, 0, 1, and 2 respectively. From the analysis, a negative score overall score would represent low ratings, whilst a net positive score for each of the categories represents a high rating.

**Table 1** Summary of contractor perceptions of framework from the validation survey

| | *Strongly disagree (–2)* | *Disagree (–1)* | *Neutral (0)* | *Agree (1)* | *Strongly agree (2)* | *Total coded score* |
|---|---|---|---|---|---|---|
| Simple to use | 2 | 8 | 12 | 48 | 9 | 54 |
| Terminology Simple | 4 | 14 | 7 | 46 | 8 | 40 |
| Framework easy to use | 7 | 12 | 5 | 39 | 18 | 49 |
| Simplifies benchmarking | 3 | 6 | 16 | 51 | 3 | 45 |
| Improves performance | 4 | 10 | 22 | 38 | 5 | 30 |
| Readiness to try the framework | 5 | 12 | 18 | 40 | 4 | 26 |

## 4 Discussion

This paper highlights the underperformance amongst contractors compared to other firms from other industries as well as that of the industry as a whole in comparison with others. Evidence from the literature reviewed shows that globally, construction firms and the industry as a whole can benefit from comparisons with leading performers from leading industries and generally with global leading industries such as the automobile sector. Such benchmarking may be based on either processes or outputs. Different levels of benchmarking have been identified in this paper with generic benchmarking proposed as the best for the construction industry.

Cross-industry comparisons with best-in-class firms help identify best practices and the levels of performance associated with performance excellence. Cross-industry comparisons enable organisations to identify the practices used by the best-in-class organisations and how such organisations attain excellence. Benchmarking models provide a framework that enables such comparisons to be undertaken. However, construction industry-specific methods for doing this are lacking. The framework produced in this paper provides a simplified and inexpensive approach to benchmarking for construction firms to undertake benchmarking programmes.

### *4.1 Benchmarking steps*

Many benchmarking models are based on the ten steps of the Xerox model, the foremost benchmarking model (Robson, 2004). Arising from this study, a ten point process for benchmarking was developed which is used in developing the benchmarking framework for the construction industry as shown in Figure 1.

The ten stages are:

1 vision/objectives set by leadership/management

2 decide what to do

3 select KPIs

4 select measures of performance

5 select success criteria

6 take action

7 collect data on results

8 assess performance

9 compare results with objectives (match best-in-class performance)

10 choose another performance improvement programme, repeat the process for new targets, or end the process.

### *4.2 How the benchmarking framework works*

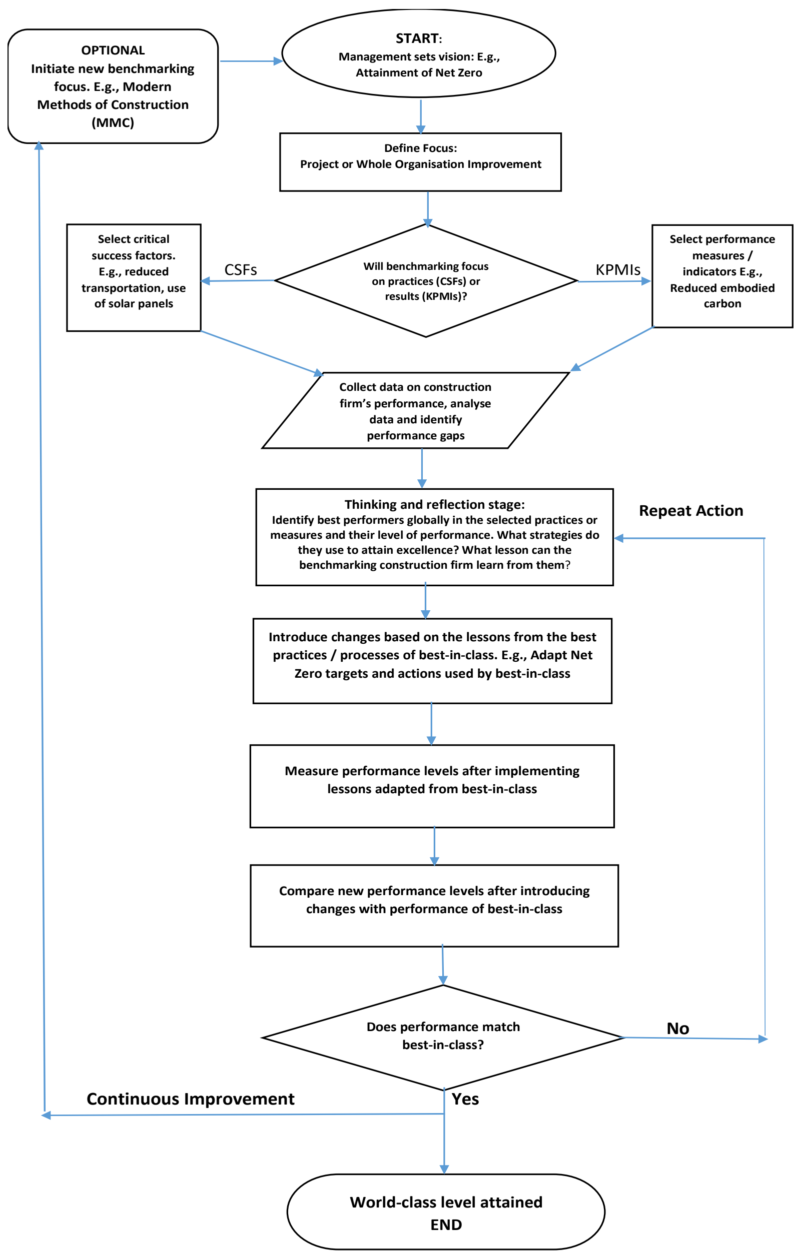
The step-by-step process for using the benchmarking framework developed for construction firms is outlined in Figure 1. The benchmarking framework can be used for self-assessment, benchmarking against best-in-class organisations, and general performance improvement efforts. In Figure 1, an example has been provided to demonstrate how the benchmarking framework can be used to attain net zero as a goal.

The process starts with the establishment of the overarching aim of the benchmarking exercise. This could be financial, technological, environmental, etc. In all cases, the process is initiated by top management which sets the vision for improvement. This first stage is critical to the overall success of the exercise and requires that objectives are clarified for all members of the benchmarking team. Following this, the benchmarking entity needs to clarify if the exercise is related to a specific project or targets companywide improvements. Once this is established, the next step will be to decide whether benchmarking will be targeted at the benchmarking entity's KPMIs or their CSFs. Entities with previous benchmarking experience may be able to benchmark both CSFs and KPMIs at the same time, but beginners and less experienced entities may target either KPMIs or CSFs separately.

In the second stage, the focus of the exercise has to be decided. This could be one of the three choices: self-assessment, benchmarking performance, or general performance improvement. Then the performance areas KPMIs which need improvement are selected together with the relevant measures of performance (sub-criteria). Next, the critical success factor (s) required to achieve benchmarking goals are selected. In the next stage, the action required to implement the success factor is taken. The results are then assessed in the context of the appropriate KPMIs and the associated performance measures. These results are then compared with world-class standards and the levels of performance associated with the best-in-class whether in the construction industry or other leading industries. Depending on the results achieved, the process of ongoing continuous improvement proceeds with either new KPMIs selected, or a different performance improvement technique may be used.

The next step involves the collection of performance data about the relevant KPMIs or CSFs. Following this, data on the relevant measures for the leading performers in the relevant measures or factors are also collected. This is followed by a thinking and reflection stage during which the benchmarking entity will reflectively consider the required actions that will be necessary to move the benchmarking entity's performance to the level of the leaders in the relevant areas of performance. Following the thinking and reflection stage, the identified actions are implemented and given a realistic time frame to take effect, after which the performance levels in the relevant areas for the benchmarking entity are measured. The new performance levels are compared with either sector leaders or global leaders. If at this stage, the performance in the selected measures or factors is lower than the best-in-class, the process can be repeated with another session of Thinking and Reflection and the process of implementing any identified actions again. Performance levels in the relevant metrics are subsequently measured again to ascertain if performance levels have improved.

**Figure 1** Conceptual benchmarking framework for construction firms (see online version for colours)



If in comparison with best-in-class entities, the new levels of performance of the benchmarking entity equal or exceed the standards of benchmark organisations, the benchmarking exercise can be repeated for different CSFs or KPMIs. Alternatively, the process can be terminated if the benchmarking entity is deemed to have attained world-class standards in the relevant performance measures. In the example illustration provided in the developed framework, this will be the attainment of the net-zero state of performance.

Whilst the potential benefits associated with benchmarking by the construction industry and by construction firms have been established, industry-specific benchmarking frameworks are lacking. Whilst there are existing frameworks developed by other industries, the unique characteristics of the construction industry make these existing frameworks makes them unsuitable for construction firms and the construction industry generally. This paper attempts to fill this gap by developing a construction industry-specific benchmarking framework. In developing the benchmarking framework for the construction industry, the identified weaknesses of the existing benchmarking frameworks have been addressed. The framework developed in this paper incorporates both success factors and performance metrics thus allowing for both practices and results to be benchmarked. Whilst the framework provides options for benchmarking both success factors ( the processes) and performance indicators or performance measures (outputs), these are not mutually exclusive. That means benchmarking can be based on processes, outputs, or both simultaneously.

A composite term KPMIs has been developed in this paper and is used to represent all essential measures relevant to performance excellence. In choosing which CSFs or KPMIs to benchmark, attention should be paid to those which are most frequently used by the most successful organisations. The framework developed in this paper considers the project nature of construction products by allowing for both organisational and project benchmarking to be undertaken. The framework is not prescriptive in terms of what can be benchmarked allowing users to identify the CSFs and KPMIs relevant to their contexts and experiences. This thus provides a framework to reflect on the areas where improvements are required and how these improvements can be achieved using the experiences of leading performers from other industries.

The key steps in the benchmarking process outlined in the Xerox Model are as follows: obtain Leadership commitment, set up a Benchmarking team, determine the focus (project or whole organisation improvement), identify the relevant practices or results, select CSFs or performance measures, identify characteristics of the selected CSFs or dimensions of performance metrics and identify the best performers in the selected practices/measures and their level of performance. The rest are, to collect and analyse data on the performance of the benchmarking firm performance gaps, develop and implement action plans based on what lessons can be applied from best-in-class companies, measure current performance levels, gap analysis, check if world-class performance attained, remedial action and continuous improvement or termination of the process (Camp, 1989; Ofori-Kuragu and Baiden, 2008). In choosing which CSFs to benchmark, attention should be paid to those most frequently used by the most successful organisations. The framework developed in this paper considers the project nature of construction products by allowing for both organisational and project benchmarking to be undertaken. The framework is not prescriptive in terms of what can be benchmarked allowing users to identify the CSFs relevant to their contexts and experiences. This provides a framework to reflect on the areas where improvements are required and how these improvements can be achieved. This is very important in the terms of the possibilities that this provides for construction firms and the industry as a whole.

The construction industry's products are each unique as a result, any benchmarking system for construction companies should reflect the peculiar nature of the industry. The uniqueness of the construction industry and its products notwithstanding, construction firms can undertake cross-industry comparisons and learn the strategies used in other industries to attain excellence. It has been acknowledged in this paper that benchmarking itself does not guarantee improved performance. However, the associated benefits which accrue from the process include opportunities to examine processes and practices and identify areas for improvement. It helps identify best practices and opportunities to learn from the experiences of global leaders. The benchmarking framework developed in this paper will enable construction firms to critically reflect on their performance against global best-in-class. It enables firms to think about and reflect on the processes and practices required to deliver improved performance. This probably is the most important benefit arising from the framework proposed in this paper. So, whilst benchmarking may not be an end in itself, it is a very useful means to the ultimate performance excellence.

The costs associated with benchmarking are prohibitive. The proposed framework's flexibility to allow comparisons without the active cooperation of the benchmark organisation will make benchmarking costs lower. This is because it precludes the need for expensive site visits and other activities which increase benchmarking costs. The results of the two validation exercises show that the developed framework is both practical and fit for purpose. Whilst the results on the participants' readiness to use and confidence in the framework is relatively low, this is reasonable and to be expected at the outset. It is expected that confidence in the framework will grow as demonstrable evidence of its effectiveness from users become available.

## 5 Conclusions

Despite significant improvements in the construction industries in many countries, the performance of even the leading construction firms generally lags behind leading firms in other industries. Evidence of this is seen in many global performance ranking lists and schemes. Whilst evidence from the literature shows that the Construction Industry will benefit generally from cross-industry comparisons, construction industry-specific methods for doing this are lacking. The potential of benchmarking as a tool for improving construction performance has been acknowledged in this paper. Whilst benchmarking does not guarantee improved performance, it will help construction firms to identify the gaps in performance and action required to raise performance. The paper proposes generic benchmarking in which comparisons extend beyond the construction industry to other industries with world-class performers. Using the model proposed in this paper, comparisons may be based on CSFs, or the new measure proposed in this paper, KPMIs. The framework provides a tool for construction firms to identify and think about the actions required for improvement based on the experiences of best-in-class firms. It provides opportunities for construction firms to target, plan for and implement improvements in some of the emerging technologies which have transferred to other industries, and which offer opportunities to improve the performance of construction firms and the performance of the global construction industry as a whole. This paper's benchmarking framework allows for inter-industry and intra-industry comparisons between construction firms. This affords underperforming construction firms opportunities to benchmark against global best-in-class organisations from other industries or against leading contractors.

## 6 Recommendations

It is a weakness that the framework has not been tested on a contractor-specific population since contractors are the main target of the framework developed in this paper. It is also recommended that the benchmarking framework be tested on a contractor-focused sample to enable a balanced judgment to be made on the feedback. To this, it should be tested by both large and small construction firms, and contractors from developed and developing country contexts to make further refinements to the framework. This will ensure the global usability and suitability of the framework developed in this paper for all classes of construction firms.

The omission of CSFs and measures of performance can be an issue for construction firms new to benchmarking. To enhance the usability of the benchmarking framework developed in this paper, further research is recommended to be undertaken on emerging technologies such as modern methods of construction (MMC), 3D construction, virtual reality, augmented reality, etc. to identify the CSFs and the performance measures and indicators. This will provide a ready pool of criteria to select from when using the benchmarking framework developed in this paper.

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