Analyzing the Causes of Poor Quality in the Construction Sector: A Critical Review

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Abstract

Construction in many nations is one of the prevalent industries that uses both skilled and unskilled labor, as well as providing an opportunity for seasonal employment of various age groups. Construction work is a major component of all infrastructure and industrial development, such as buildings, highways, airports, railroads, hospitals, schools, housing, dams, irrigation systems, etc. With increasing growth in the construction industry, the construction business has become a competitive environment in recent years. To keep up with this competitive challenge, organizations throughout the world employ many factors, such as public-sector awards, profits derived from changes instead of sticking to the initial bid, access to state-subsidized financing, and preference for constructors who employ unionized workers, among others. One of the main factors for firms to consider in such a competitive environment is the need to strike a balance between the level of end-product quality and concomitant expenses. The increasing costs of material supplies and wages greatly impact construction activity costs, thus raising expenditures for businesses and organizations. Although a number of studies have been conducted over the past two decades to address these issues, there is still a gap in the current literature review. Therefore, the aim of this paper was to theoretically assess studies on the cost of poor quality in different sectors. The results of the critical analysis of the current literature clearly demonstrates that there are flaws in the current body of knowledge related to the choice of company size and the research methodology used.

Keywords
Cost of poor quality, construction sector,

1. Introduction

As one of the greatest businesses around the world, the construction industry assumes a critical part towards the social and monetary improvement of any nation. Socially, it furnishes groups with places for lodging, instruction, culture, pharmaceutical, business, recreation, excitement and in addition urban foundation, for example, railways, ports, roads, power and water supply, drainage, sewerage and telecommunications (Roodman and Lenssen, 1995). Economically, according to Wibowo (2009) and Mthalane, Othman and Pearl (2007), the construction sector adds to a nation's economy by giving the greater part of the nation's fixed capital resources and framework that help different ventures, making openings for work, and expanding national Gross domestic product (GDP). The construction sector encourages customers to achieve better value for money, for work done by construction companies through the bettering of local construction businesses (Ofori, 2000a). It represents one of the mainstays of the local economy in any nation (Xiao & Proverbs, 2002a, 2002b) and as a controlling arm for government in order to facilitate or slow down economic activities (Edum-Fotwe, Thorpe & McCaffer, 2001). Also, it is known as an industry which offers benefits that produces construction goods, including initiation, outline, development, occupation or operation and annihilation stages (PMI, 2004). It is a highly risky, small profit generating sector and has a reputation for client

dissatisfaction (Jha & Devaya, 2008). Same opinions expressed by Jha & Devaya (2008) are that the construction sector is prone to risk because of political, legal, financial and cultural difficulties.

Smith (1998) calls it an organization of design and build. Smith (1998's) definition underlines also construction action rather than design. A more extensive meaning of the construction sector gives a comprehensive view as one which manages new structures and adjusting, expanding, renovating, keeping up, repairing and demolishing of existing constructions or structures. Structures according to (Barrie & Boyd, 1978) are said to be housing constructions, commercial or public buildings, roads, civil works and manufacturing facilities. It is clear from every one of the definitions, that the construction sector influences numerous aspects of human life and adds to them (Mlinga & Wells, 2002). The previous shows that the construction sector is a vital division of the economy and has different backward and forward links to different other sectors. The construction sector conceivably participates enormously to socio-economic improvement and work (Abdullah, Chiet, Anuar & Shen, 2004; Giang & Pheng, 2011). It is a critical pointer of financial activities and is frequently utilized by government to cause growth or aid monetary recuperation from recession. Besides, it gives a stage to rivalry for freelancers (Edum-Fotwe et al., 2001).

2. Background

The construction industry is a significant contributor to the world economy. The products of this industry provide the necessary public infrastructures and private physical structures for many daily activities such as services, commerce, utilities and other industries. The industry is not only important for its finished product, but it also employs a large number of people (directly and indirectly) hence the effect on the economy of a country during the actual construction process (Wibowo, 2009). Similarly, Dlamini (2012) has also noted the strong relationship between the construction industry and economic growth, specifically in terms of the provision of capital infrastructure. The importance of the construction industry and its many significant contributions are also noted by many studies (Xiou, 2002; UKCG, 2009; Khan, 2008; and Dlamini, 2012) specifically in terms of impacts on Gross Domestic Products (GDP), economic activities, government revenues, benefit of investment and nation-wide employments.

At present the global construction industry is recovering from the recent economic downturn from 2007 to 2009, and countries are taking measures to ensure the continued prosperity of their construction sector. According to Baldauf-Cunnington and Hubbard (2011), constrained lending and fiscal measures to address budget deficits in mature markets such as the UK will have a major impact in determining the future of the construction industry. Contrastingly, in fast growing emerging markets, such as Asia and Latin America as well as the frontier markets in the Middle East, population pressures will drive demand for investment in the built environment and fiscal space will allow governments to pursue these plans. Furthermore, in developing nations such as Malaysia, Indonesia and Vietnam, the construction industry is simply too important to be allowed to stagnate or even further decline. Wirahadikusumah and Pribadi (2011) emphasized that the additional pressure from trade liberalization in the construction industry will soon initiate the radical improvement in the process of construction.

3. Gap identification in the current literature

The studies assessed were generated by the ISI Web of Science database provided by the University of Johannesburg Library. The search of the key words (Cost of poor quality), after focusing the research based on language (English), countries (USA, Australia, England, China, India, Nigeria, South Africa), time frame (1997-2017), peer review articles and research area, yielded in over 271 documents from which the top 15 studies were chosen and thoroughly assessed by means of title and background with the purpose of developing additional boundaries and eliminating incorrect entries. Throughout this phase, groups of inclusion and segregation standards were established against which, individually, every single journal article was evaluated. Precisely, article assessed are those, which focused on the cost of poor quality. It should be pointed out that studies that did not meet these requirements were not taken into account. This stage generated 152 studies focused on the cost of poor quality in construction, food processing, steel and automobile industries. These studies were labeled on the basis of a set of standards, for example in this paper, the studies were selected based on the citation. To this end, the table below shows the 15 best studies that were critically analyzed.

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Authors and years	Type of Industry				Company Size		Research Methodology		Country
	Construction	Food	Steel	Automobile	SME	Large	Qualitative	Quantitative	
Ford (2002)	x					x	x		USA
Attalla et al. (2003)	x					x		x	USA
Koehn et al. (2003)	x				x	x	x		USA
Love et al. (2003)	x				x	x		x	Australia
Shetty (2009)		x				x	x		England
Li et al. (2001)			x			x		x	China
Mehri (2006)				x		x	x		USA
Tam et al. (2006)	x					x	x		China
Brown et al. (2000)			x			x		x	USA
Sagar et al. (2009)		x			x		x		India
Liu et al. (2013)			x			x		x	USA
Shokrani et al. (2012)			x			x		x	England
Olotuah (2000)	x				x		x		Nigeria
Huang et al. (2012)	x					x		x	China
Mills et al. (2009)	x				x		x		Australia

David N. Ford et al. (2002) developed a study based on Achieving Multiple Project Objectives through Contingency Management. They stated in their work that project managers utilize budgets to fulfil various objectives such as cost control, short durations, and high quality. Gaining knowledge on how managers apply budget contingencies requires a dynamic information processing model of how managers establish a connection between high project complexity and limited managerial capacity. The authors reported the results of gathering contingency management procedures of real estate development project managers and described an active simulation model of contingency management. The model was used to test theories of the efficiency of aggressive and passive management strategies on expense, timeliness, and value of facility. The results of the study showed that managers were found to chase general project goals in their management of contingency. In the end, an aggressive strategy was found to be more vigorous but had a poorer performance than a passive strategy. The study concludes with the prevalence of trade-offs between robust and high-performance contingency management policies in construction projects and the importance of incorporating uncertainty into project planning and management. By focusing on a large company size and a quantitative approach, the study failed to educate on the situation of SMEs and the results of a qualitative approach.

Mohamed Attalla et al. (2003) focused their work on Predicting Cost Deviation in Reconstruction Projects. Their paper investigated the perplexing environment of reconstruction projects and described the progress of a predictive model of cost deviation in projects with high risks. From a survey of construction professionals, information was acquired on the reasons for cost overruns and poor quality from 50 reconstruction undertakings. Based on the information received, 36 factors were acknowledged as having direct influence on the cost performance of reconstruction projects. Two techniques were employed to develop models of predicting cost deviation: statistical analysis, and artificial neural networks (ANNs). Even though both models had similar accurateness, the results showed that the ANN model was more sensitive to a greater number of variables. This study contributed to a better grasp of the reasons behind cost deviation in reconstruction projects and provided a decision support instrument to quantify that deviation. The approach used by this study was a quantitative one and focused on large companies and failed to cover a qualitative methodology and the application of the work in SMEs.

Enno "Ed" Kohen et al. (2003) based their work on the Quality, Environmental, Health and Safety Management Systems for Construction Engineering. The thinking behind quality, environmental, and safety (QES) management systems is a notion that has been recognized by numerous contractors. The authors stated that an operative QES program not only guarantees a quality product but also decreases costs, and improves productivity. It is a top down process, i.e., upper management as well as line management and other workers develop the program and encourage all personnel to abide by the process. This paper offered a discussion of the development of a segment of a QES management system which has been used by a medium to large size company but fails to show an application for a small construction company. Also the study has more of a qualitative methodology and therefore fails to provide results based on a quantitative approach.

Peter E. D. Love et al. (2003) focused their research on Benchmarking, Benchaction, and Benchlearning: Rework Mitigation in Projects. According to the authors, the Australian government has issued numerous demands to improve the performance of the construction industry. A deficiency in available benchmark measures has made it hard, if not impossible, for companies to identify which matters to aim for process improvement. A major factor that has been found to be a factor to poor administrative and project performance is rework. Using the results of a questionnaire survey, the paper presented and discussed a series of benchmark measures for the sources and expenses of rework for 161 construction projects. The study proposed a generic structure for benchmarking rework at the edges of a project's life cycle, and used unstructured interviews to have the proposed structure validated by industry practitioners. The study's focus on a qualitative methodology fails to educate the reader on the results issuing from a quantitative methodology.

Prakash Shetty (2009) investigated the incorporation of nutritional considerations when addressing food insecurity. Speaking of the issues of global food security will profit from the coinciding incorporation of nutritional priorities that are part of the good health of populations. The inclusion of nutritional thoughts, when improving accessibility to food, widens the scope and objectives of agriculture and food production and consequently play a part in an integrated concept of food and nutrition security. The low quality of food and dearth of variety in the usual diet of many who live in the emerging world inflicts huge costs on societies in terms of ill health, lives lost, diminished economic productivity and low quality of life. Sustainable food-based methods to allow proper intake of micronutrients consist of dietary diversification and biofortification. Agriculture and agricultural biotechnology do not just offer the opportunity of augmenting crop harvests, thus increasing food security, but also have the potential to better the micronutrient content of foods, thereby participating in the attainment of both food and nutrition security. This research utilized a qualitative methodology to investigate the matter and consequently failed to yield results from a quantitative point of view.

B. Li et al. (2001) discussed the Principle and Simulation of Fixture Configuration Design for Sheet Metal Assembly with Laser Welding. The authors state that the quality of the stamping procedure has an immediate impact on laser welded sheet metal assembly. The fixture plays a crucial role in the adequate metal fit-up that laser welding entails. The traditional "3-2-1" locating system will no longer be sufficient for the deformable laser sheet metal assembly procedure. Due to the often low stamping quality, a multifaceted die fixture has to be utilized to meet the metal fit-up requirements. The die fixture matches an "infinite-2-1" locating system where the cost of the tooling is incredibly high and yet is short of flexibility. This restricts the implementation of laser welding. This study proposed a new locating system with both total locating and direct locating for welds. A total locating system is utilized to locate the general assembly, and a direct locating system is employed to locate the weld location, which is critical for ensuring proper metal fit-up. The paper developed a finite-element model and a prevention and correction technique for the direct locator setting. A case study was used by the authors to demonstrate that the proposed technique is effective for sheet metal assembly for laser welding. The study applied a quantitative methodology to a large size company thus failing to provide an application for an SME and to develop a qualitative approach to the research.

Darius Mehri's (2006) point of interest was the darker side of lean: An insider's perspectives on the realities of the Toyota Production System. The Toyota Production System (TPS) has been acclaimed as the summit of flexible, just-in-time manufacturing and design and the originator of "lean work" systems, which state to better the manufactured goods quality and worker productivity. American car manufacturers eagerly adopted the "Toyota Way". The author of this paper worked in a Toyota group company for three years, studying the system first-hand and leading his own qualitative study on what he believes to be the real influence of lean work: the human cost. Mehri's evaluation is led by a division which is crucial to comprehending Japanese culture and business: tatemae (what you are supposed to feel or do) and honne (what you actually feel or do). He believes that the international eagerness for the Toyota Production System ensues from western observers' lack of discernment for the honne within the tatemae. He reveals the convention and communications from management at Toyota—the tatemae—that confuses the veracities—the honne—of the Toyota Way: restricted possibility for originality and novelty, limited professional skills, worker segregation and harassment, hazardous environments on the production line, industrial accident cover-ups, unnecessary additional hours, and low quality of life for employees. Although he brought significant contribution, he failed to provide a quantitative approach to the work.

In this paper, Vivian W. Y. Tam et al. (2006) evaluate Existing Waste Recycling Methods: A Hong Kong Study. They stipulate that environmental issues have been regarded as a serious situation in the construction sector of Hong Kong. Waste management is persistent about the alarming signal warning the sector. Reusing, recycling and reducing the wastes are considered the only means to recover from the waste generated; however, the applications still have much room for progress. In order to better the current situations, this research studied assessments of the current waste recycling techniques. The study investigated a telephone interview of the recyclers, location visits to the construction and demolition sites and the centralized recycling plant in Tuen Mun Area 38. The authors also investigated complications faced for various recycling crews. Instead of the low quality found from the recyclable materials, they found that the major barriers for them were caused by the high investment cost, lengthy demolition period and limited space. Therefore, a few recommendations were suggested. This particular study investigated using a qualitative methodology and gave us results based on the study of large company. It therefore failed to provide a quantitative approach to the issue at hand as well as a perspective from a small enterprise.

Karen A. Brown et al. (2000) focused on predicting safe employee behaviour in the steel industry: Development and test of a sociotechnical model. Safety in the industry is a crucial matter for operations managers — it has repercussions for cost, supply, quality, and social concern. Insignificant accidents can obstruct production in numerous ways, and a serious accident can close down a whole operation. In this perspective, questions about the sources of factory accidents are greatly significant. There is a widespread belief that workers' risky behaviour are the main reasons behind workplace accidents, but a few of writers propose a viewpoint that emphasizes impacts from operating and social systems. The study described here take up this topic by evaluating steelworkers' answers to a survey regarding social, technical, and personal elements connected to safe work behaviors. The results offer proof that a series of events of technical and social concepts function through personnel to encourage safe behaviors. These results establish that safety risks, safety philosophy, and production demands can impact safety efficiency and inconsiderate attitudes, on a trail leading to safe or unsafe work behaviors. The study adopted a quantitative methodology in the research thus failing in considering and providing a qualitative approach to the issue.

Sagar V. R. et al. (2009) based their work on the recent advances in drying and dehydration of fruits and vegetables: a review. Fruits and vegetables are dried to improve storing stability, minimize wrapping condition and reduce transportation weight. Conservation of fruits and vegetables through drying based on sun and solar drying methods causes low quality and product pollution. Energy use and the quality of dried products are important parameters in the choice of drying process. An optimal drying method for the preparation of quality dehydrated products is cost efficient as it cuts down the drying time and causes least damage to the product. To decrease the energy use and operational cost new technologies came up in drying practises. Among those technologies, osmotic dehydration, vacuum drying, freeze drying, superheated steam drying, heat pump drying and spray drying have great scope for the production of quality dried products and powders. The research was done through a qualitative approach which resulted in a failure to cover a quantitative methodology.

Bin Liu et al. (2013) subject of research was Large-Scale Synthesis of Transition-Metal-Doped TiO2 Nanowires with Controllable Overpotential. Practical application of one-dimensional semiconductors into appliances able to exploit their unique properties is often delayed by low product profits, low quality material, high production cost, or general lack of synthetic control. Here, the authors showed that a molten-salt flux scheme can be utilized to manufacture large amounts of high-quality, single-crystalline TiO2 nanowires with controllable dimensions. Moreover, in situ dopant combination of numerous transition metals consent to the alteration of optical, electrical, and catalytic properties. With this arrangement of control, sturdiness, and scalability, the molten-salt flux scheme can deliver high quality TiO2 nanowires to fulfil a wide range of application needs from photovoltaics to photocatalysis. The quantitative methodology applied in this study corresponds to a failure from the authors to cover a qualitative study.

A. Shokrani et al. (2012) based their work on Environmentally Conscious Machining of Difficult-to-Machine Materials with regards to Cutting Fluids. Machining difficult-to-machine resources such as alloys employed in aerospace, nuclear and medical industries are generally followed by low productivity, poor quality surface and small tool life. In spite of the broad usage of the expression difficult-to-machine or hard-to-cut resources or materials, the area of these sorts of resources and their properties are not yet well-defined. Alternatively, using cutting fluids is a usual technique for bettering machinability and has been recognized since early 20th century. Nevertheless, the environmental and health dangers associated with the utilization of regular cutting fluids together with developing governmental protocols have caused an increase in machining costs. The goal of this study is to assess and classify the materials called difficult-to-machine and their features. Additionally, the paper studied various cutting fluids and defined major health and environmental concerns about their utilization in material cutting industries. Finally, the study reviewed and discussed progresses in reducing and/or eliminating the utilization of regular cutting fluids. The authors based their research on a quantitative approach and focused on large enterprises and neglected to provide a use for SMEs and a qualitative point of view.

A.O. Olotuah's (2000) work was centered on the Recourse to earth for low-cost housing in Nigeria. The focus of this paper is the provision of low-cost houses for the poor in Nigeria. The author stipulates that quality housing improves the health and wellbeing of man and contributes greatly to his productivity, thus highlighting its significance as an essential need. The provision of low-cost houses is linked to the availability of strong and reasonably priced building materials. This paper supported the utilization of building earth because of its fairly lower-cost than that of more common modern materials and its large quantity in the country. Additionally, the material has thermal assets which make it idyllic for building in the tropical climate. This study's methodology was mostly qualitative which failed to enlighten the reader on the quantitative approach to this problem.

Li Huang et al. (2012) did a study about the demand for air movement in warm environment. They stated that as the leading regulation instrument of indoor thermal environment in warm seasons, air-conditioners are utilized to maintain a cool environment. Nevertheless, this causes difficulties of enormous energy utilization and low air quality inside. In comparison, electric fans guarantee an indoor cooling effect as well as low energy utilization. This justifies the investigation of air flow utilization. This paper debates on the results of a research comprising both an online survey and a series of climate chamber experiment to investigate user needs for air movement in their everyday life. The results yielded by the online survey showed that electric fans were generally accepted in both homes and offices as they were environmentally sensible, cost less and could offer a cool environment. The climate chamber experiment's results found appropriate range of indoor temperature to utilize electric fans and their equivalent array of air speeds. With rational use, electric fans could deliver a healthy and energy-efficient method to control indoor environment. The focus of this research was on a quantitative methodology. The authors failed to consider a qualitative approach to the issue.

Anthony Mills et al (2009) conducted a study on the Defect Costs in Residential Construction of Australia. They stated that the residential construction industry is a crucial element of the economy of Australia; the industry

utilizes a very prominent section of the national labor force, and yet the industry is afflicted by defective work and poor quality. They argued that previous studies have revealed that defects and rework are widespread in the residential sector. In their study, they discussed the nature of the major defects and examined the effect of contractor type and building type. In order to compute the extent of defects being recorded in new residential construction, this paper offers an analysis of defects that were recorded by a government-owned housing insurance company, the Housing Guarantee Fund. The data utilized in their research were not based on a sample like the previous studies they reviewed but instead, it represents all new houses built in Victoria, Australia from 1982 to 1997. After analyzing the data, they found out that out of eight houses, one reported defects, and that the cost associated with restoration was 4% of the construction contract value. Their paper discusses the nature of the most important defects and investigates the impact of contractor type and building type. Their study leaned more on the quantitative approach and therefore failed to provide a qualitative approach which would have provided different results. This paper also failed to focus on the cost associated with the poor quality of the constructions.

4. Conclusions

Construction in many nations is one of the prevalent industries that uses both skilled and unskilled labor, as well as providing an opportunity for seasonal employment of various age groups. Construction work is a major component of all infrastructure and industrial development, such as buildings, highways, airports, railroads, hospitals, schools, housing, dams, irrigation systems, etc. With increasing growth in the construction industry, the construction business has become a competitive environment in recent years. To keep up with this competitive challenge, organizations throughout the world employ many factors, such as public-sector awards, profits derived from changes instead of sticking to the initial bid, access to state-subsidized financing, and preference for constructors who employ unionized workers, among others. One of the main factors for firms to consider in such a competitive environment is the need to strike a balance between the level of end-product quality and concomitant expenses. The increasing costs of material supplies and wages greatly impact construction activity costs, thus raising expenditures for businesses and organizations. Although a number of studies have been conducted over the past two decades to address these issues, there is still a gap in the current literature review. Therefore the aim of this paper was to theoretically assess studies on the cost of poor quality in different sectors. The results of the critical analysis of the current literature clearly demonstrates that there are flaws in the current body of knowledge related to the choice of company size and the research methodology used.

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