

A LITERATURE SYNTHESIS: IS CONSTRUCTION INDUSTRY LOW RESPONSIVE TO CHANGE AND DEVELOPMENT?

Chandanie Hadiwattege* and Sepani Senaratne
Department of Building Economics, University of Moratuwa, Sri Lanka

ABSTRACT

Construction faces many challenges, but one of its principle challenges is lack of innovation and research. This research tries to understand why the construction sector is slow to innovate and whether the industry needs to innovate. Further it discusses the role of academia as a prominent researching body in such a change. There are many reasons behind the slow responsiveness of the industry and it has been identified that economical characteristics of construction industry could be a major reason which creates lack of performance-based competition. Further, the inherent characteristics of the construction sector influence this slow innovation. Despite this slowness, there is a need for the industry to innovate with the global challenges taking place in the industry. Academia has an important role to play here in merging academic research to industry development needs. However, academics' choice in research area is mainly driven by the context, availability of funding and personal interest, rather than on industry requirements. It is believed that the Sri Lankan industry could be innovated with the correct cooperation of academia with the evidence from other countries. The PhD research which this research paper is based aims to merge academic research into construction industry requirements to build a better responsive industry. As a preliminary step, this paper reports on the literature findings on whether the industry is slow to innovate and the reasons behind this.

Keywords: Construction Industry, Innovation, Development, Academic research.

1. INTRODUCTION

The construction industry faces many challenges. It is considered to be one of the most important industries in the economy. However, construction is different from many other industries with its unique characteristics. Nowadays, one of its principle challenges can be considered as lack of innovation and research which could be generated from the synergies amongst opportunities, capacities, resources and incentives. This paper tries to discuss the level of innovation in construction industry which is an important issue for the development of the sector. The paper gives some evidence to support the hypothesis that construction industry lacks in adaptation of innovation together with some possible reasons for the slow response. Further it discusses on why the industry need to develop with innovation. Finally, it addresses upon what should be the academia's proper response to back-up the industry with academic research to move ahead with innovation happening all around the world.

2. INNOVATION, CHANGE AND DEVELOPMENT AROUND THE WORLD

Innovation changes the world. Innovation can be generated from the synergies amongst opportunities, capacities, resources and incentives. According to Meek *et al.* (2009), countries with robust innovation systems privilege research in a variety of contexts including universities and the private sector. In recent years, the changing external environment has seen some governments place unprecedented emphasis on research as a key motor for national development. This has led to new challenges for research management, and to universities expanding their research links with industry, commerce and government, and the community at large. Further, Laszlo and Laszlo (2002) strengths the idea, the knowledge economy is an emergent reality for many organisations and Nation states, "the wealth of a nation no longer depends on its ability to acquire and convert raw materials, but on the abilities and intellect of its

* Corresponding Author: E-mail - chandaniqs@yahoo.com

citizens” (TFPL, 1999, p.2). This highlights the importance of updating the practical knowledge with the research.

According to Meek *et al.* (2009), innovation in developing countries poses very different challenges, in terms of understanding the process and of building systems for innovation. The lack of investments in research, low success in getting a substantial share of research funds from abroad and not considering themselves being in a position to make the necessary investments and benefit from the increasing opportunities for access to high-quality knowledge are a few key challenges. Further, increased global competition in higher education and research, and the related information systems on “World-Class Universities” and indicators of “cutting-edge” research are more likely to underscore gaps than to motivate the less privileged to ‘catch up’. Moreover, transnational education provided or assisted by economically advanced countries might be low in quality, and might exploit those paying for it in many cases; the low- and middle- income countries have limited capacity for reviewing the quality of programmes and preventing the obvious low-quality programmes from spreading on their territory. On the other hand the resource pools for research in many low- and middle-income countries, even if financially sufficient, might be too small to compete with the larger pools of other countries. The programme goals of transnational education programmes and the paradigms of research might be so driven by the perspectives of economically advanced countries that the needs of low- and middle-income countries are neglected or even suppressed is another challenge for developing countries.

The identified background of innovation in common is very much aligning with the specific situation of construction industry nowadays. Especially the challenges for researchers to bringing in development to a specific sector are clearly seen at the construction background as discussed below.

3. PRESENT AND FUTURE OF CONSTRUCTION INDUSTRY

The construction industry is considered to be one of the most important industries in the economy. It interacts with nearly all fields of human endeavours. However, Pathirage *et al.* (2007), discuss that the construction industry is considerably more fragmented than many other industries. As to Toakley and Marosszesky (2003), the end users of the product will ultimately bear the costs through rent, lease or purchase and whose business are beneficially or adversely impacted by the effectiveness of the built infrastructure within which they operate. As a result of combination of process fragmentation, product complexity, poor definition of quality attributes and the “one off” nature of many projects, high level and consistent quality achievement is difficult to achieve both during the design and the construction process and particularly in terms of the whole-of-life performance of completed facilities.

Further, the services offered by the professional organisations are characterised by being highly tacit knowledge intensive in nature, together with wide range of professionals involved, working as an inter-disciplinary team in delivering the construction products (Løwendahl, 2000). In addition, the concept of the knowledge worker (Green *et al.*, 2004) has long been important within the construction industry, which is considered to be one of the labour intensive sectors of the economy compared to other industries.

These issues confirm how vulnerable the construction industry for challenges with its integrated characteristics. Construction therefore faces many challenges at the present and it will be at an increased rate in the future. But one of its principle challenges can be clearly seen as the lack of innovation and research. This is different from many other industries and it slower the innovation and development in construction sector.

4. CONSTRUCTION INDUSTRY RESPONSE TO CHANGE AND DEVELOPMENT

Today, in a highly competitive world, construction organisations need to adapt continuously to complex and changing conditions. With that only they could survive and proliferate through innovation. The internal dynamics of construction organisations must be such that they can respond to change by adapting their structure and orientation to reflect, and be able to respond to change (Steele and Murray, 2004). It is

therefore important for the construction industry to move beyond the traditional practices to adopt new practices arising from research and development activities.

One can argue that the standard of innovation in the construction industry is good (MacLeod, 2010). However, major construction industry reviews in the Europe have identified the need for continuous performance improvement (Hughes and O'Rourke, 2009; Fairclough, 2002; Egan, 1998; Latham, 1994). The Latham (1994) report highlighted lack of innovation as being a likely result of low profit levels and clients who insist on a dominance of lowest-price criteria to award contracts. Further in 1998, Egan envisage the requirement of movement for change with committed to improving the delivery of projects and the performance of companies. The movement would be a network through which members could collaborate with each other in developing construction techniques and skills and exchanging ideas for increasing efficiency and quality. Later in 2002, Fairclough emphasised the influence of lack of innovation. R&D is an important driver of innovation. No valid argument was presented to justify the construction industry being any different therefore R&D is as important to the construction industry as any other. But it is not given the same priority as measured in R&D expenditure as a proportion of turnover. However the problem is continuing as to Hughes and O'Rourke (2009), development drives change in the construction sector as research and development (R&D) activities lead to innovation. However, the pace at which these developments are integrated and implemented in the sector is slow. The main barriers to unfolding the potential of these developments are unawareness, knowledge, competences among construction companies, and incentives.

Further, skills agenda is at the heart of current day organisational development. Without sufficient people with the requisite skills, companies will be unable to fulfil their potential for growth. It is difficult and there is a global battle for talent which is becoming more intense. While firms were probably slow to recognise it, the ability to attract, retain and develop skilled people is increasingly a required core competence (O'Donnell, 2008). Outdated skills of professionals in a particular firm will be therefore a strong disadvantage in the highly competitive construction environment. This emphasises the need for updating knowledge of the workers comparatively with the new knowledge generation. As an example, after more than two decades of investment decline, the profile of the engineering and construction industry in South Africa has been enhanced and demand for related human capital and leadership talent has increased. However, Wall and Ahmed (2008), point out that organisations are faced with increasing costs to train employees in today's high technology environment. According to Hall and Sandelands (2009), the primary challenge lies in the development of basic skills, the procurement and development of strategic and professional leadership and the protection of experience.

Further, the statistics on the construction industry strengthens the notion of low responsiveness to the changes as well as the low development rates compared to the other industries (Bettelle, 2010; Sabol, 2007; Koebel, *et al.*, 2004; Fairclough, 2002). Fairclough (2002) explains the statistical results of his study which is as another evident for the universally recognised reality that the industry must improve its performance. There are many pressures not least of which is the need for the industry to become more profitable and at the same time, deliver better value for money. This represents a significant challenge to the entire construction community, its processes and technologies, as well as to its clients and customers who must demand buildings whose economics are considered on a whole life basis. R&D has a pivotal role to play here but the effort needs to be carefully focused on those activities in which the industry will invest either out of enlightened self-interest or to respond to the demands of clients and government policy. In a study by Koebel *et al.* (2004) has found out that almost of all types of stakeholders believe it is highly important to adopt new building and construction products, materials, and practices but in actual situation very low percentage of usage was recorded.

In a study by Sabol (2007), has proven that less innovation adaptation as a possible reason for lack of productivity improvement of construction labour forces compared to the other industries. On the other hand, as the project teams rarely remain the same from one project to the next, information flow and methods of innovation diffusion are hindered by constantly changing team compositions and lack of teammate-to-teammate familiarity. Multiple, non-hierarchical teams from different organisations find themselves with little incentive to share knowledge or methodologies as there is lack of information technology developments are adopted by the construction industry. According to Bettelle (2010) the

research results on R&D funding, even the volatility accompanying the recession has passed, current economic conditions still remain fragile. The impact of the overall economic climate in 2010 leads to a forecast a modest 2.4% growth forecast for U.S. R&D in 2011. This low growth rate has assumed a likely decline in federal R&D funding in 2011, as many federal agency budgets are likely to be cut over the next year. Hence, the situation of construction research was critical under such circumstances as the fund percentages upon related industry is something already comparatively low.

Research and development (R&D) activities, therefore, important to the construction industry to successfully address the challenges placed upon it and to be competitive (Kulatunga *et al.*, 2009). However, as to Pheng and Hua (2002), there is lack of evidence that construction industry adopts new findings of academic research into their practice as discussed next.

5. CONSTRUCTION INDUSTRY REQUIREMENTS TO DEVELOPMENT AND INNOVATION

With the above background it is clear that the construction sector is slow to innovation. However, before stressing that the industry need to respond to the R&D activities it is important to check whether there will be an important impact upon the construction industry if this R&D is integrated. Therefore this section presents some key advantages of adopting R&D in to the construction sector which have been identified by different researchers in different countries to highlight how the innovation would upheld the construction sector.

Maqsood and Walker (2007), therefore presents an important point, as effective adoption and diffusion of innovation has the potential to increase construction industry productivity. However, according to Sheffer and Levitte (2012), “integral innovations” that involve new interfaces and/or new integration procedures across the boundaries of firms/professions/trades are adopted far more slowly. Mediating this effect, vertical and horizontal integration of design and construction specialty firms involved in integral innovations significantly increase their rates of adoption.

Further by reapplying experience and avoiding the same mistakes, design and construction companies can realise cost efficiency improvements and increased design and performance quality. Thus, knowledge and experience become important intellectual assets. They are an integral part of the value creation process (Le and Bronn, 2007). Hence, such particular input should be included in research studies that aim to develop construction industry.

According to MacLeod (2010), in the construction industry there is a proportion of people who have good to excellent natural ability for innovation and who may have trained with people with such ability. Further, Wall and Ahmed (2008) discuss that it as a key driver in addressing the issues identified in many of the studies has been the recognition that learning and training are key elements in delivering good construction projects.

On the other side, according to Fairclough (2002), it is universally recognised that the industry must improve its performance. There are many pressures not least of which is the need for the industry to become more profitable and at the same time, deliver better value for money.

The global trends in construction sector nowadays, are in number of new different directions. The trends have helped polarise the financial and technical superiority of the developed countries and the corresponding inferiority of the developed countries in the region of the developing ones. Hence different global and Asian development trends suggest that the internal dynamics of construction organisations must be such that they can respond to change by adapting their structure and orientation to reflect, and be able to respond to change (Steele and Murray, 2004).

Further, Brandon (1982) has called for a “paradigm shift” in the research and practice of determining building costs – that was one of the first public pronouncements of the drastic need for radical change in how construction processes are researched and practiced. At that time, it seemed that the terms were not well appreciated, nor the alleged needs, particularly clear. However, in the years since Brandon’s call, innovations have taken place and “new paradigms” have appeared but the questions remain of how far it

has come – how much has the knowledge developed and to what extent have the methods improved to benefit humankind? (Fellows, 2010; Brandon, 2009).

Barrett (2007) states that Research and Development (R&D) can contribute to finding solutions to the challenges faced by the construction industry and making it highly valued by its customers. According to Kulatunga *et al.* (2005), the contribution from R&D to the development of the construction industry is immense as it enhances the effectiveness of construction organisations and raises the international competitiveness through technological advances and managerial developments. Further, R&D acts as a valuable input for the construction organisation by developing new products, materials, advanced construction processes, to meet the customer requirements and to address the economic, environmental and resource constraints.

These views suggest that it is important for the construction industry to move beyond the traditional practices to adopt new practices arising from research and development activities. Therefore, today in a highly competitive world, construction organisations need to adapt continuously to complex and changing conditions, with that only they could survive and proliferate through innovation.

6. ACADEMIC RESEARCH INTO CONSTRUCTION INDUSTRY - POSSIBLE REASONS FOR LOW RESPONSIVENESS FROM THE CONSTRUCTION SECTOR

According to Ordoñez and Serrat (2009), where efforts to disseminate knowledge products are earnest, low impact is mainly attributable to poor planning and the absence of a dissemination strategy. Traditionally, it is found that the academic researchers and the construction industry practitioners do not collaborate closely in most construction research projects. There is a perception among the construction practitioners that the academic research is more focused on subjects and issues which are not crucial for the construction industry. The practitioners also claim that the academic research results are sometimes inapplicable and impractical to use in real- life construction projects. The researchers on the other hand argue that the construction industry practitioners often do not entertain innovative research ideas which require a major change in the industry practices and procedures. This situation dictates the need to enhance the researcher-practitioner collaboration to conduct research on problems which are vital for the construction industry and to find out adoptable solutions (Azhar, 2007). In addition to this major reason, there are some more other reasons which need to be considered as discussed below.

Jones and Saad (2003, cited Maqsood and Walker, 2007) argue that the construction industry has considerable barriers to accepting innovation in general, mainly due to its culture of conservatism, lack of appropriate leadership, poor learning organisational orientation, lack of investment in people and its timidity in leading the adaptation of new technologies. These issues make it very difficult for the construction industry to make significant inroads to investing in the adoption and diffusion of innovation. Further this is largely driven by technology push rather than demand pull.

One more reason is lack of investment on R&D by the industry. NZCIC (2006) explains this is due to the nature of the way in which the construction services are purchased. As the construction client base is mostly formed out of relatively uninformed owners, there is little premium possible in prices to fund R&D. Many private owners purchase services relatively infrequently and have no interest in the long term viability of the industry whose services they wish to purchase.

Another reason is the industry's short-term focus on achieving project goals. Observations of Dubois and Gadde (2002) indicate that the industry as a whole is featured as a loosely coupled system. Project success is dependent on the performance of the participants amongst other factors, who are entrusted to execute the project. Due to the complexity, dynamism, and uncertainty of the construction industry, project team is required to deliver high quality projects at lower costs in shorter times (Oyedele, 2010, Sexton *et al.*, 2007).

Lack of training for professionals can be another reason for the slow responsiveness. Practitioners require flexible education and training that complements work place experience rather than distracts from professional obligations. As a result of globalisation and technological development, people have to adapt to a number of changes at a personal and professional level at rapid pace, which increases the need for

continuous learning throughout adult life (Reissner, 2005). Hence the lifelong learning is going to be a key requirement for construction professionals. As to Amaratunga *et al.* (2010), it is evident that there is a strong connection between the skills and employability. The more skills and knowledge one will demonstrate the more chances available for him getting employed. Therefore it is important to focus on matching the skills requirements with the level of skills one possesses which could be achieved by lifelong learning. However, even though significant opportunities exist to develop more mature workers already active in the workforce there is little evidence of using technology-based learning applications in construction related postgraduate course provisions (Hall and Sandelands, 2009).

Further, Sexton *et al.* (2007) have identified that the structure of the industry is seen to inhibit innovation. As an example, UK construction industry is predominantly made up of firms made up of less than five people, who have limited capacity to innovate due to their management abilities, limited resources and reduced opportunities for supply chain driven innovation because of their inability to form long-term relationships with other firms. Moreover, the adversarial culture of the industry which ushers in detrimental short-termism and opportunism manifest in procurement arrangements between project team participants. The net effect of this is that construction firms are commonly characterised as being conservative, risk averse, invest little in research and development, and look to suppliers to be the stimulus of innovation.

These reasons in total have made the construction industry less responsive to innovation. Next section tries to explain whether the industry really needs to do better, amidst its slow innovation and barriers to innovation.

7. RESPONSIBILITY OF ACADEMIA IN PROMOTING SECTOR DEVELOPMENT

The need for sharing knowledge between research institutions and industry has become increasingly evident in recent years. According to European Commission (2007), historically research institutions were perceived as a source of new ideas and industry offered a natural route to maximising the use of these ideas. However, the past decade has seen a significant change in the roles of both parties. Many companies are developing open innovation approaches to (R&D), combining in-house and external resources, and aiming to maximise economic value from their intellectual property, even when it is not directly linked to their core business. In particular, they have begun to treat public research as a strategic resource. In parallel, it has become clear that research institutions need to play a more active role in their relationship with industry in order to maximise the use of the research results. This new role requires specialist staff to identify and manage knowledge resources with business potential, i.e. how best to take a new idea to market, ensure appropriate resources (funding, support services, etc.) to make it happen, and to obtain adequate buy-in by all stakeholders.

Learning and knowledge sharing are essential drivers of innovation in order to sustain long-term competitive advantage of organisations. In a study of Sparrow *et al.* (2009), it has been identified that much of the research and practice of university-industry interaction is rooted in transfer of research expertise from universities to industry. Communicating research outcomes lies at the heart of academic endeavour, because it contributes to improved knowledge and understanding and guides further research. However, the bigger the project and the higher the level of the degree, the more likely it is that research outcomes will be worth communicating beyond the basic requirements to the broader research community. This may be beneficial to both the advancement of research in the particular field of interest and to the academic careers of the research graduates (Hays, 2007).

On the other hand, academia has an interest in fashionable management concepts since they have high practical relevance (Dean and Bowen, 1994). The popularity of fashionable management concepts in fact contrasts with academic discourse, which is virtually ignored by practitioners (Hambrick, 1994). Therefore, the relationship between academic discourse and popular management concepts is tense; possibly even antagonistic (March, 1991).

However at present, relationships between academia and industry are increasingly intimate and commercial. While opportunities are created for each partner, there are also important conflict of interest

issues. Particularly challenging is ensuring that universities maintain their traditional role in public science while partnering with a commercial entity with a tradition of proprietary science (William *et al.*, 2004).

8. SUMMARY AND WAY FORWARD

The construction industry faces many challenges. It is considered to be one of the most important industries in the economy. However, construction is different from many other industries with its unique characteristics. Nowadays, one of its principle challenges can be considered as lack of innovation and research. Innovation can be generated from the synergies amongst opportunities, capacities, resources and incentives. Countries with robust innovation systems privilege research in a variety of contexts including universities and the private sector. Product and process development and innovation allows companies to gain competitive advantage, attract new customers, retain existing customers, and strengthen ties with their distribution network. This means that it is important for the construction industry to move beyond the traditional practices to adopt new practices arising from research and development activities. The internal dynamics of construction organisations must be such that they can respond to change by adapting their structure and orientation to reflect, and be able to respond to change. However significant evidence could be given from the industry to support the argument that the industry is slow in innovation adaptation. At the same time, it is argued that the construction industry has considerable barriers to accepting innovation in general, mainly due to its culture of conservatism, lack of appropriate leadership, a poor learning organisational orientation, lack of investment in people, poor planning and the absence of a dissemination strategy, lack of investment on R&D by the industry, industry's short-term focus on achieving project goals, lack of training for professionals, limited capacity to innovate due to their management abilities, limited resources and reduced opportunities and its timidity in leading the adaptation of new technologies as some exemplary reasons for the slow responsiveness. The need for sharing knowledge between research institutions and industry has become increasingly evident in recent years. However, relationships between academia and industry are increasingly intimate and commercial. While opportunities are created for each partner, there are also important conflict of interest issues. A collaboration where the interests and values of each partner were articulated in advance and conflict of interest issues were resolved before legal and business arrangements were established in a contract is the correct path to head off. Even though the construction industry of Sri Lanka appears to be less pensive to the innovation, it could be put in to the correct track with correct changes happening in both sides: academia and the industry. Developed countries provide evidence for possibility of the identical scenario.

The focus of this research therefore is on merging of research and practice to create a better responsive construction industry for Sri Lanka. The “gap” referred here as the “slow responsiveness to change” has been identified with the reasons coming from both the academic side and the industry side. Hence, the academics and practitioners are both under pressure with the challenges they face. Academics are challenged when trying to implicate the research in to the practice especially as the research are in two directions as pure and applied. Moreover, the industry is having the challenge of moving away from the traditions and to go ahead with current development trends. Research and development therefore will be the key in addressing this issue. However, there are also some difficulties in terms of funds and the researching ability. This urges the need of merging the research and practice which will be the way forward. In merging the research and practice there are some critical requirements to be addressed with the preliminary requirement of developing relationships between researchers, funders and the practitioners. The forecast here is that, a success in merge will end up with a better responsive construction industry for Sri Lanka, which is strongly backed with knowledge created though academic research.

Hence this research aims to explain how to merge academic research and industry development requirements to have a better responsive construction industry practice in Sri Lanka.

In order to achieve the aim, the objectives have been set as follows;

- Explore the nature of researches undertaken by construction related academics in Sri Lanka.
- Explore the construction industry development requirements in Sri Lanka.
- Explore the current link between academic research and industry practice with the reasons for existing gap.

- Develop guidelines to merge academic research with industry development requirements.

The aim with these objectives will be explored through a “mixed research method.” As a research method, the mixed method focuses on collecting, analysing, and mixing both quantitative and qualitative data in a single study or a series of studies. As Cresswell, (2006) explains, its central premise is that the use of quantitative and qualitative approaches in combination provides a better understanding of research problems than one approach alone. Surveys will form a part of the mixed method which will be followed here, which is discussed by Fowler (2008) as a method with the purpose to produce statistics, that is, quantitative or numerical descriptions about some aspects of the study population. In order to meet the first two objectives therefore two opinion surveys will be carried out. According to Yin (1994), case study is an in-depth inquiry in its real setting that offers an explanation, exploration or description based on the case study actors, when the boundaries between the phenomenon and the context cannot be separated. Hence, a case study will be followed to achieve the third objective of the research. Based on the findings of the first three objectives, the final objective will be achieved at the end. Data which are to be collected based on this mixed method will be analysed scientifically. Conclusions will be made thereafter with the use of findings and a guideline will be developed to direct researchers and practitioners to create a better responsive construction industry for Sri Lanka.

9. REFERENCES

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