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INNOVATION DRIVERS IN CONSTRUCTION

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The construction industry is labeled as an industry that highly sticks to established practice without sufficient innovation. Nowadays, construction organizations strive for survival by adopting cutthroat pricing to the detriment of product quality. This approach stifles long-term competitiveness. Innovation can be defined as "successful exploitation of new ideas, where the ideas are new to unit of adoption". Providing an accurate definition is considered to be one of the most crucial means to enhance competitiveness. In spite of enormous literature on the definitions of innovation, there are limited studies exploring barriers and drivers of innovation in the Hong Kong construction industry. This study aims to fill those research gaps. Barriers to developing innovations have been identified, as well as the nature of the construction industry, conventional methods of procuring projects, and risks and cost of innovations. Discovering ways to identify opportunities and drivers of innovations have been explored through a case study. It is found that an innovative procurement system, sufficient information exchange, and a progressive employer drive innovations.

Keywords: Competition, Hong Kong, Case studies.

1 INTRODUCTION

The construction industry often has been described as an industry that lacks innovation, and construction organizations tend to adopt tried and tested methods of production. Innovation is the best hope to channel competition away from cutthroat pricing into product and construction process improvement (CIRC 2001, WEF 2013). The idea that innovation could "elevate" competitiveness, however, had several barriers. At its simplest, construction contractors face keen competition, and tend to underprice and provide inferior products. However, innovation, in this view, would have an indirectly salutary effect upon competitiveness among those contracting organizations with research and development. This chicken-and-egg dilemma definitely stalls the construction industry. Construction costs in Hong Kong have rocketed with ever-increasing project complexity in recent years. Thus, the opportunity to make good use of new challenges to step up innovation is hampered. Despite the definition of innovation being well defined, there is little exploration on the difficulties and opportunities for developing innovations in the Hong Kong construction industry. As such, this study aims to fill the research gap by (1) reviewing the definition of innovation, (2) investigating the challenges and barriers to be innovative, and (3) exploring the opportunities and drivers for innovations in the Hong Kong construction industry.

2 THE DEFINITIONS OF INNOVATION

The term "innovation" has been defined in various fields. Egbu *et al.* (1998) define innovation as "successful exploitation of new ideas, where the ideas are new to unit of adoption". The idea is not necessarily to be brand-new to each organization, but it has to be perceived as new for those organizations that adopt it. As such, applying, re-applying, as well as developing existing knowledge are also some forms of innovation. An improvement must be novel to the development of change. Roberts (1988) emphasizes that innovation is different from invention that has an add-on feature of exploitation. Invention is a process of creating a new idea and gets it to work, whereas exploitation refers to commercial development and dissemination process of the invention. Roberts (1988) pinpointed the practicability of innovation in real-life situations.

The operationalization of the definition of innovation shall be responsive to the characteristics of construction industry. According to Blayse and Manley (2004) and Marceau *et al.* (1999), "B[uilding] & C[onstruction] is partly manufacturing (supplies and materials, components, equipment) and partly services (engineering, designing, surveying, consulting, even hiring, leasing and management). It is also much more than that, since the essence of B&C is the "coordination of a very large number of different products and services and their transformation into a 'road', 'airport', 'office block' or 'hospital'….". Marceau *et al.* (1999) also described B&C as a product system.

Four types of innovation are applicable to the construction industry, including product, process, organization, and technology. First, product innovation refers to the increase in quality of a product. In other words, the outcome of product innovation is an improvement in services or products to the customers (OECD 1997, Tykkä *et al.* 2010). Second, process innovation is the implementation or adoption of new methods that significantly improve production or delivery. The result of process innovation is therefore improvement in productivity (Tatum 1989). Through process innovation, changes in equipment, or in methods of working in terms of human resources (or a combination of both) may be involved (OECD 1997). Third, organizational innovation refers to a substantial change in organizational structure, execution of advanced management techniques, or a significantly-altered corporate-strategic orientation (OECD 1997, Asad *et al.* 2005). Last, technological innovations are the use of state-of-the-art technology to enhance building systems. For example, advanced building safety assessment methods and environment monitoring devices are now an integral part of so-called intelligent buildings. In summary, innovations in the construction industry can be categorized as: product, process, technology and organization.

3 THE CHALLENGES AND BARRIERS TO INNOVATION

3.1 The Nature of the Construction Industry

Completing a construction facility requires the collaboration of a multidisciplinary project team. Each contracting organization in the project team has to maximize its profit, but profit motive often conflicts with the project's goals (CIRC 2001). The development of a shared vision is a good resolution, but it sometimes does not happen when the formation of the project team is a one-off task. The fragmented and temporarily project team has to make twice the effort to contribute to the whole

construction process (Blayse and Manley 2004). More importantly, it is often difficult to transfer knowledge from one project team to another, thus stifling innovation.

3.2 Conventional Procurement Method

No mechanism of innovation has been factored into the conventional notions of procurement. More importantly, employers often tend to award a contract based on price factors under traditional competitive bidding (Atkin 1999). Contractors adopt this rather short-term approach as a means of staying competitive by offering cutthroat prices. Thus there is little room for contracting organizations to consider innovation in construction.

3.3 Risks and Costs of Innovation

Different extents of risks and uncertainties are involved in every innovation (Asad *et al.* 2005, Sexton and Barrett 2003). This disincentivizes contracting organizations from innovating. The final products of construction, such as bridges and buildings, are highly durable, so tried-and-tested methods are preferred (Atkin 1999; Blayse and Manley 2004). Also, there are high costs during the process of innovation that involve resource allocation, which is at the own cost of the innovator in the first place.

4 THE OPPORTUNITIES AND DRIVERS OF INNOVATION

4.1 Integrated Procurement Approach (IPA) – Kai Tak Site 1B, Hong Kong

The Hong Kong Housing Authority (HKHA) first introduced the Integrated Procurement Approach (IPA) in 2009. It is a procurement method that takes innovation into account. It involves three-envelope procurement. The commonly-used two-envelope tendering procurement system refers to tenderers' submission of technical and price envelopes respectively. The three-envelope system takes technical, financial, and innovation proposals into account during the tender evaluation process. Under this, the proportion of consideration of total non-price factors is increased from 40% to 45%, meaning the price factor becomes 55%. The innovation envelope is divided further into two sub-envelopes: (a) technical submission (i.e., a list of alternatives as innovations), and (b) price adjustment (i.e., corresponding benefits and costs). The score obtained in sub-envelope (a) is counted in the non-price score, whereas the scores obtained in sub-envelope (b) is factor in composing the price score. The total non-price score will be reflected by a bundle of factors, such as master planning, detailed design, construction technology, and the technical submission of innovation.

Kai Tak Site 1B is located at Kowloon East as part of Kai Tak Redevelopment after the removal of the international airport to Chek Lap Kok. The site occupies 5.7ha, which is one of the most sizable developments in recent years in Hong Kong. This development provides approximate 8,000 public-rental housing flats. The features of the procurement are as follows:

4.1.1 *Early involvement of contractors and the appointment of a Dispute Avoidance Advisor*

The involvement of contractors in the pre-tender stage allows for expertise from designers and builders etc. to be considered for enhancing public housing quality. By appointing a Dispute Avoidance Advisor, the project team was able to seek independent advice to minimize disputes during the pre-contract stage.

4.1.2 *Acquisition of intellectual property rights*

One of the highlighting features of IPA allows one-off lump-sum payments for acquiring intellectual property rights of innovation proposals from unsuccessful tenders. This provides an opportunity for HKHA to incorporate innovative ideas from unsuccessful tenders into the awarded tender. There were 88 innovations from 3 tenders, covering a wide range of aspects such as environmental-friendly/green materials, energy-efficient systems, water-saving systems, advanced concrete mix designs, precasting, and use of information technology. One notable example of innovation is the iCrete^{TM} System. It is an environmentally-friendly concrete design and production system enhancing durability and sustainability.

4.1.3 *Workshops*

The HKHA project team has organized workshops for the purpose of sharing experience among all the tenderers. Through these workshops, successful and unsuccessful tenderers, as well as the HKHA project team members, interact to facilitate meaningful exchange among practitioners.

4.2 IPA – A process innovation

From the above, IPA brings several benefits. Through IPA, tenderers have generated green ideas such as iCrete^{TM} System. In addition, applications of some innovative ideas have been made to other projects. IPA stimulates improvement in products, which cannot be achieved using conventional methods. It is in line with the definition of process innovation given by the OECD (1997). Therefore, IPA is considered to be a process innovation by the Hong Kong Housing Authority. IPA has also been adopted in 2012 in Anderson Road Site A, and Site B Phase 1 and 2 in Kwun Tong. An estimated total of 7,200 public-rental housing flats will be provided in 2017. In general, IPA has been adopted in two sizable public housing projects.

4.2.1 *Innovative procurement system*

The HKHA offers a platform upon which innovations from tenderers have been stimulated in Kai Tak Redevelopment via IPA. Innovation proposals submitted by tenderers involve integration of design input and construction functions, which leads to improved characteristics of the final product (Blayse and Manley 2004), such as smaller environmental impacts. Thus the innovative procurement system can be said to be a driver of innovation.

4.2.2 *Information exchange*

In Kai Tak Redevelopment, HKHA, as the leading organization, has arranged workshops to gather practitioners and sharing groups for the exchange of information and expertise. The cohesion between participants has been enhanced (Atkin 1999). Moreover, the early involvement of contractors can facilitate the flow of expert opinion that improves the project outcome. Through experience-sharing sessions, an integrative culture among professionals from different disciplines has been created. Future co-operation is possible between different parties. This paves the way for developing innovations through brainstorming.

4.2.3 *HKHA – A progressive employer*

The HKHA pays for the acquisitions of intellectual property rights of the innovations. Thus the risks and cost have been shared by the HKHA. Moreover, the HKHA is one of the largest employers providing quality and affordable housing in Hong Kong, accommodating 28% of Hong Kong's total population as of September 2013 (HKHA 2014). It is also possible to apply innovative products acquired through Kai Tak Redevelopment to other projects. With the considerable size of HKHA, innovation has been encouraged, since this creates a market for adopting innovative products (Bossink 2004).

5 CONCLUSION

For the construction industry in Hong Kong, the downsides of cutthroat pricing have been brought to attention. Construction organizations underprice the work by sacrificing the quality. This hampers competiveness in the long term. Innovation is believed to be a critical pillar of competitiveness. With innovation, one is able to survive with improved products. However, construction organizations tend to stick to conventional approaches. Thus this study has been carried out to investigate the barriers to and drivers of innovation in the Hong Kong construction industry. It is found that the nature of the construction industry, conventional procurement methods, and risks and costs of innovation hinders construction organizations from being innovative. An innovative procurement system, information exchange, and a progressive employer can be drivers of innovations. The limitation in this study is that it focuses only on process innovation. Further investigations on the different types of innovation has to be done, as the drivers of innovation given above are not exhaustive. Since developing innovation is vital to enhancing competitiveness, the inter-relationship of innovation and competitiveness offers opportunities for future research.

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