

SUITABILITY OF TRADITIONAL PROCUREMENT SYSTEM FOR GREEN BUILDINGS IN SRI LANKA

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ABSTRACT

Green building construction is a momentous process of sustainability. It signifies the environmental credibility of sustainable. Further, it addresses the energy performance, overall cost of the construction product and conservation of natural resources. Therefore, green building concept has foremost influence on construction industry. Yet, it has core barriers in cost, knowledge, risk and government factors when involve the green construction to construction industry. Hence, procurement system can involve in reducing those barriers. Green procurement signifies both product and process of the construction. Concerning the process base, there are different procurement systems involved in different countries which depend on internal and external factors. There is high involvement in design and build procurement system worldwide which include Sri Lankan context as well. The status of applying traditional procurement system in green construction is significantly high even though it is not considered as highest. Therefore, it has high involvement on addressing the barriers through critical factors of traditional procurement system. It was carried out nine expert survey with qualitative analysis in order to identify involvement of traditional procurement system to green building construction. Accordingly, it focused on the critical factors of traditional procurement system specifically cost, time, complexity, client's involvement, project characteristics and technology. These success factors addressed the barriers which raised through high cost, lack of knowledge, risk and other influences of green building construction. Finally, this research subsidizes to knowledge, green procurement system provides the benefits to increment of green building construction in Sri Lanka.

Keywords: *Green Building Construction; Green Procurement; Procurement; Sustainability; Traditional Procurement System.*

1. INTRODUCTION

According to Low *et al.*, (2014) “the greening buildings have become one of the most effective strategies for sustainable development”(Pg. 414). Author Liu *et al.*, (2012) “Efforts on green buildings have generally focused on energy efficiency, conservation of natural resources, new environmentally friendly building materials and also revolutionary changes in concepts of design, procurement and management processes to bring about greater reduction in overall environmental impact of buildings” (p. 51).

Selecting a suitable procurement system is a major function that has to be adopted in building construction (Chan *et al.*, 2001). Procurement has become important to a project

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in overall quality in economics, social and environmental aspects (Oyegoke, *et al.*, 2009). There are common factors which affect to procurement system such as economic, legal, political, technology, client resources, project characteristics, variation, cost issues and time (Davis, *et al.*, 2008).

“Green procurement is the purchase of product or services which minimize or provide positive environmental impact.” (Wong *et al.*, 2016). Yet, this research identified the involvement of procurement systems to green building construction with emphasizing the status of traditional procurement system, addressing the barriers of green buildings construction and overcome them with success factors and identify the critical factors of traditional procurement systems which can address the barriers occur in green building implementation. According to literature findings, it is confirmed that many researchers have conducted research regarding green buildings and procurement, yet researches regarding green procurement system are done in less numbers. There are several researched has been carried out for overall green procurement system. Conversely, the depth study on traditional procurement system involvement on Green building has not been covered which identified as problem statement in this research. Hence, the aim of this research is to investigate the applicability of traditional procurement system to the procurement of green buildings in Sri Lanka.

2. LITERATURE REVIEW

2.1 SUSTAINABLE CONSTRUCTION AND ENVIRONMENTAL SUSTAINABILITY

Sustainable construction helps the building industry to achieve development by resolving the issues of environmental, cultural and socio-economic. In addition to that with proper management of all the features, the sustainable construction seeks to reduce the additional cost of all designing, constructing, operating and overall cost welfare (Shafii, *et al.*, 2006). The environmental sustainability ensures that the environment and humans are interacting naturally (Bombugala and Atputharajah, 2010). The authors Hwang and Leong (2013) also proved the status by stating that “the term green building is defined as an environmentally sustainable building which is constructed with minimal environmental impacts” (p.312).

2.2 GREEN BUILDING IN CONSTRUCTION

According to Seyis and Ergen (2017) green building is high performance buildings that are designed and constructed in resource efficient manner to preserve energy, water, material and land through application environmental principals. It categorized under six (6) main parts as shown in Figure 1.

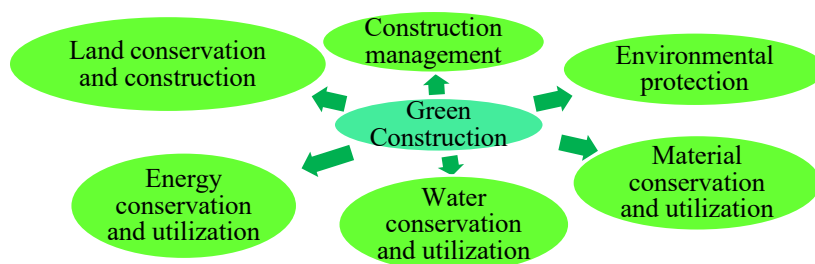


Figure 1: Green construction categorization (Source: Adapted from Shi, *et al.*, 2013)

2.3 PRACTICES IN GREEN BUILDINGS

The employers make effort for pursuing the green building in order to enhance the building performance (Hettige, *et al.*, 2016). Due to the significance of the green building, it has increased the popularity among architectural, engineering and construction industry in different countries as well (Li, *et al.*, 2018).

2.4 MOTIVATING FACTORS OF ADOPTING GREEN BUILDINGS

There are several benefits can be gain through green buildings which are also categorized as economic, social and environment benefits (Waidyasekara and Fernando, 2012). As examples lowering energy, water wastewater costs. As social example expand market for environmentally preferable and as for environmental negative impact and mitigate carbon emission (Thatcher and Milner, 2016).

2.5 BARRIERS IN IMPLEMENTING GREEN BUILDING TECHNOLOGY

There are several barriers identified when implementing green technology. As the main barriers which directly influence when implementing the green building technology there are six barriers identified as shown in Figure 2.

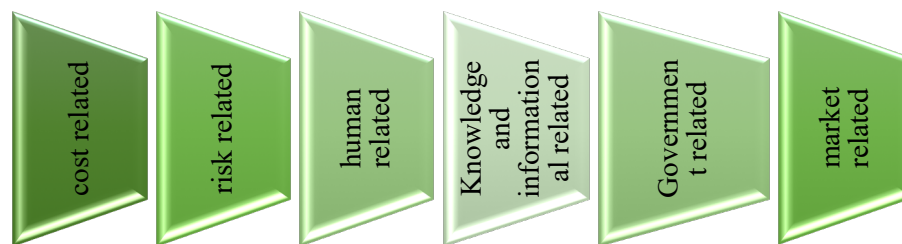


Figure 2: Barriers in implementing green building technology (Source: Adapted from Chan *et al.*, 2018; Sim and Putuhena, 2015)

2.6 PROCUREMENT IN CONSTRUCTION

Procurement in construction is the process of contributing employers’ satisfaction through the suitable process of designing and constructing. Rwelamila (2010) also defines procurement as distributing responsibilities among stakeholders and organization with defining relationship of project elements of construction project.

There are four (4) types of procurement system as in, separated, intergrated, management oriented and collaborative.

Table 1: Classification of types of procurement system

Ref	Separated	Integred	Management Oriented	Collaborative
R1	Traditional, Lump sum, Cost reimbursement Provisional quantities	Design and build (D&B) Novation, Package deal/ Turnkey Contractors design and construct	Design and manage Management contracting Construction management	-
R2	Lump Sum Measure and Pay Prime cost	D&B, Package Deal Turnkey, Develop and Construct	Construction Management Management Contracting D&M	Partnering Joint Ventures Alliancing

		Novated, Concession Contracts All-in contracts		Voluntary Arrangements
R3	Design bid build	D&B, Design Partnership Novation	Design, Build and Manage Management contracting Construction management Building own operate transfer	Partnering

Sources: R1 - Love, *et al.* (1998); R2 - Shiyamini, *et al.* (2005); R3 - Vilasini, *et al.* (2011)

2.7 FACTORS AFFECTING SELECTION OF PROCUREMENT SYSTEMS TO THE CONSTRUCTION

The selection of suitable procurement system is a significant process in both employer and project participant perspective as the selection can affect the project failure or success.

Table 2: Success factors for selecting a procurement system

Reference	Factor
Mathonsi and Thwala, (2012)	Client’s requirement
Davis, <i>et al.</i> , (2008); Jefferies <i>et al.</i> , (2002)	Economical, Commercial, Technological, Political, Legal, Social
Cheung, <i>et al.</i> , (2010); Davis, <i>et al.</i> , (2008)	Resources, Project characteristics, Variations, Responsibility, Authority
Jefferies <i>et al.</i> , (2002)	Environmental impact, complexity, support, Selecting the right project, Org. size-resource management ability, trust, Community support, Financial capability
Chan <i>et al.</i> , (2001)	Constrains imposed by End-Users

2.8 PROCUREMENT SYSTEMS IN GREEN BUILDINGS

Green building procurement is procuring concerning environmental impact of the building (Bohari *et al.*, 2017). As per the Stener (2002) the green building procurement system is also defined as a technical implication, construction procedure which involves the procurement aspect.

2.9 ADOPTION OF GREEN PROCUREMENT TO BUILDINGS

Green procurement is identifying, integrating and implementing of green practices in the procurement procedure which is a complex process and commences at the planning stage and continues to contract execution (Bohari *et al.*, 2017). A product base is concerned about the standard and the environmental friendliness of materials and products.

When implementing any procurement system such as conventional, design and building or partnering to green buildings there is an desired environmental criteria of the product and services as guideline for the design team and construction team (Bohari *et al.*, 2017).

2.10 APPLICATION OF PROCUREMENT SYSTEM TO GREEN BUILDINGS

Ahn, *et al.*, (2016) explained that the green building constructions are actions of multidisciplinary team. Further, as stated by Ahn, *et al.*, (2016) South Korea has used the design bid build system with intergrated construction process which is considered as the most popular method in South Korea. According to Rose (2014), most suitable procurement system was identified as collaborative system and D&B and also the auther further stated that least suitable system as traditional procurement system. Therefore, according to unique features of the countries they have identified different procurement systems as suitable procurement system.

3. RESEARCH METHODOLOGY

The data collection commenced with a pilot survey and un-structured interviews of experts. Qualitative analysis was carried out to analyze data. Due to lack of experts who have involved in procurement systems and green building construction at the same time qualitative approach is selected. It was preceded with interviewing experts gathered with one pilot surveying which was carried out to clarify the research area, the interview guideline and also to verify literature findings and to clarify debatable points in literature and 9 expert interviews who have involved in different project with playing different roles such as consultant, contractor and site engineer. Content analysis method was used to analyse the data with the method of N-vivo (2012) software. Finally, after whole process is completed the expectation of the researcher is to identify all objectives and answer the research problem.

4. RESEARCH ANALYSIS AND FINDINGS

4.1 PILOT SURVEY AND EXPERT SURVEY

Through the survey, barriers that influence to green building construction which have integrated to procurement system were identified and also identified the client's perspective regarding the selection of a suitable procurement system to the relevant project. The concerns and facts of the respondents were also emphasized through this survey.

Main concerns of this analysis were factors affecting the selection of a suitable procurement system and the barriers that has to overcome in selecting green buildings.

4.2 STATUS OF PROCUREMENT SYSTEMS IN GREEN BUILDINGS

It was recognized that the awareness of other procurement systems to green buildings such as management oriented and collaborative systems are less than traditional and D&B procurement systems (see Figure 3). Based on the results, 50% of projects are conducted by D&B procurement system. Thus, it clarifies that the most of the green building constructions are proceeded through D&B procurement system. Yet, as the traditional procurement system provides 43%, it can be considered that traditional procurement system is also used reasonably.

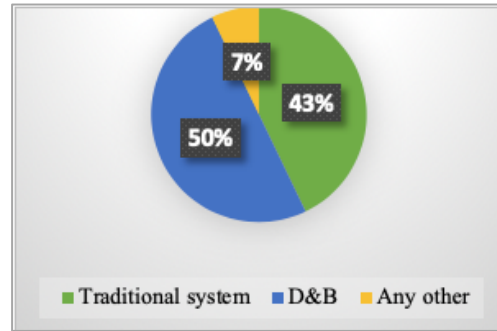


Figure 3: Selection of procurement systems of green buildings

4.3 BARRIERS IMPLEMENTING GREEN BUILDING TECHNOLOGY

According to respondents, green buildings have a major impact on global changes in sustainability. Also, most of the respondents agreed that economic features have a higher impact for global change in sustainability than the social impact. There are seven barriers as identified as Cost, Human, Market, Government involvement, Risk, Knowledge and Interest of People and they have relationship with each other (refer Figure 4).

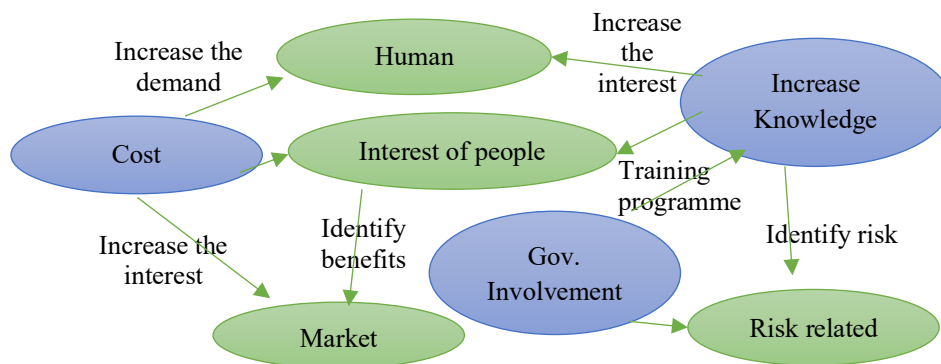


Figure 4: Impact of barriers and mitigation of barriers

Green building construction is a complex construction system. With identified barriers it gets more complicated. Hence, these barriers should be addressed to reduce the complexity of the project itself. As shown in Figure 4 cost reduction helps to increase the interest of people and also the interest of the market. It helps to increase the demand of human as well. With the increasing knowledge, people will aware of the risk beforehand. Further, it helps to identify the benefits resulting interest among the people. Also, human related barriers will be reduced with the people's interest. With the government involvement, it increases the knowledge due to the implementation of programmes and reduce the risk.

Those identified solutions are general solutions which can be addressed to mitigate the barriers. Other than above identified solutions, the barriers can be addresses in construction aspect as well.

4.4 SELECTION OF TRADITIONAL PROCUREMENT SYSTEM (TPS)

Selecting a suitable procurement system has a major impact on the development of green building construction. It can be changed due to several reasons such as cost, time, project characteristics and client's requirements as identified factors.

Selection of a procurement system depends on the current status, internal factors and external factors as identified in the literature review. There are seven critical factors of traditional procurement system which identified through success factors of procurement system as in, Cost, time, complexity, client involvement, project characteristics, technology and variation.

There is high involvement of cost, client involvement and project characteristics in selecting traditional procurement system. So, with analyzing responses it further identified that the positive impact of those identified factors when implementing traditional procurement system.

Table 3: Impact of the factors to select traditional procurement system as suitable system to green buildings

Factor affecting TPS	Level of Impact	Reason for the impact
Cost	Highest impact	Due to less variation, Prior identification of the cost
Time	Impact	Due to less variation
Complexity	Higher impact	Work commence with client's involvement
Client involvement	Highest impact	Direct involvement
Project characteristics	Higher impact	Follow client's scope
Technology	Impact	Reduced unnecessary cost

Consequently, it identified that most of factors have high impact when selecting a traditional procurement system as suitable system. There is less impact in time and technology compared to other factors. Yet, through the respondents' opinions it verified that how those factors affect to selection and what are the benefits that can be gain through selection of traditional procurement system. Therefore, through critical factors of traditional procurement system it can address the barriers of green building construction and helps to increase the green construction in long run.

Considering barriers identified and factors affecting to TPS, the relationship can be identified as illustrated in Figure 5. Figure 5 illustrates what factors address the barriers. According to that there can be one factor that can address several barriers.

5. CONCLUSIONS

Development of construction industry has become obliging with involvement of sustainability. In Sri Lankan construction industry, there is less increment of green building construction due to numerous reasons highlighting the lack of knowledge on green aspects. There are different types of procurement systems which are involved in construction industry. The proper selection can address the client's requirement, financial issues, management risks and procedure of the work. Implication of suitable procurement system influenced to reduce the complexity of the green building construction. This research is based on mapping above two concepts of green construction and procurement systems. Therefore, with providing the solution to research aim, which is investigating applicability of traditional procurement system to the procurement of green building in Sri Lanka was established along with identifying objectives.

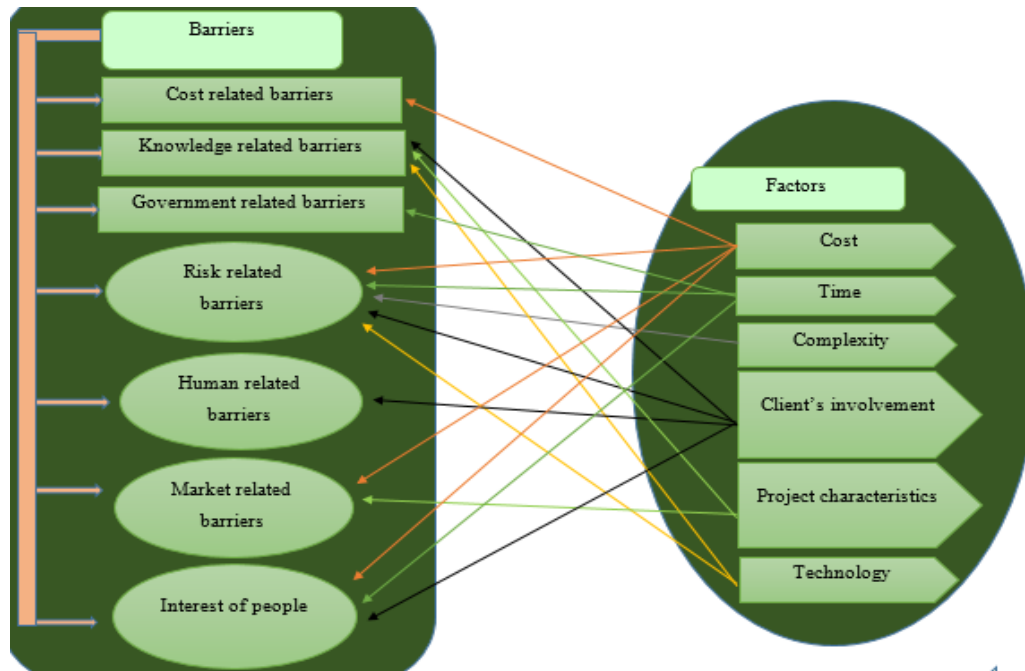


Figure 5: Address the barriers through critical factors

As main identification the application of procurement system in green building construction is analysed. As a result, the status of applying traditional procurement system to Sri Lankan context has identified as second highest implication in Sri Lanka. Then identified how the barriers can be addressed through procurement system and finally involvement of traditional procurement system with critical factors to address the barriers. It identified there is significant involvement in traditional procurement system and it can successfully address the barriers of green building construction. Accordingly, this research has addressed the research problem and contributed to knowledge on increasing the green building construction through procurement systems.

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