

## TRANSACTION COSTS OF GREEN OFFICE BUILDING CONSTRUCTION IN SRI LANKA

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### Abstract

Although the concept of Green Building is popular in other countries, it is not yet so in Sri Lanka as no clear identification of the transaction cost of green buildings has so far been made. Given the expanding scope of construction of office buildings in Sri Lanka, it has become important to differentiate between the transactions costs of green buildings from those of conventional buildings. Hence this research is aimed at studying the transaction costs of green office buildings in Sri Lanka. A literature synthesis was carried out to learn about the green building concept and the benefits of green buildings. Identification of the transaction cost components was done through three preliminary interviews and two case studies conducted through semi structured interviews that were aimed at comparing the cost components of each building type with those of the other type. The findings revealed that the transaction costs of green buildings in Sri Lanka relates to costs incurred for preliminary studies, managing the designs, gaining knowledge on green certified material, technical advice, documentation and commissioning for LEED certificates and quality checking by obtaining the services of green consultants. Hence, the state agencies need to ensure that green material is available at discounted prices, take steps to present awards to professionals involved in green building and conduct seminars for the benefit of these professionals. It is also recommended that the Green Building Council should lower its commissioning fees to encourage the developers to obtain green certificates so that the concept of Green Building in Sri Lanka is promoted.

**Keywords.** *Cost Components; Green Building, Office Building, Transaction Cost*

### 1. Introduction

Construction activities are an integral part of a country's national economy and industrial development (Khan, 2008). The rapid growth of the world's population and rapid urbanization lead to a higher consumption of the world's limited resources (Kats, 2003). The construction industry has a responsibility to utilize environmental resources in an ecologically

sustainable manner (Fernando, 2012) since the buildings are responsible for more than 40 percent of the global energy used, and as much as one third of global greenhouse gas emissions, in both developed and developing countries (United Nations Environment Programme, 2009).

Green buildings consist of environmentally sustainable building elements, which can deliver benefits to society by saving environmental resources (Urbecon, 2008). Despite the merits of green buildings as far as the owners, occupants, society at large, and environment are concerned (Baird, 2010). They have a higher initial capital cost compared to that of traditional buildings (Johnson, 2000; Kat, 2003). The Transaction Cost (TC) is referred to in terms of risk, time delay, uncertainty, and information search, setting up cost etc. (Qian, Chan & Khalid, 2015) and also in terms of increased architectural and engineering (A&E) design time, modeling costs and time necessary to integrate sustainable building practices into projects (Kats, 2003). Even though the design of green buildings is critical in terms of cost components (Richard, 2008), if integrative design techniques are properly employed, TC of green buildings should become less than that of conventional buildings (Rehm & Ade, 2013). Additionally, Malin (2000) has argued that considering the life cycle cost advantage, a higher initial cost which is associated with certain types of green material will not be an expense. Hydes and Creech (2000) have studied the use of green building as the reuse of building material and equipment can be considered as more beneficial.

According to data made available by the Central Bank reports, the construction of office buildings is on the increase in Sri Lanka. Thus, a successful investigation on transaction costs incorporated with Green office building construction would lead to introduce new trends in construction industry. Therefore, a study to identify and analyse transaction costs of green buildings against conventional buildings in Sri Lanka has become necessary in order to fill the gap in literature and to face the demands of the construction industry which if expanded can rapidly boost the country's economy.

## **2. Concept of Green Building**

The construction industry has a negative impact on the environment in a number of ways; i.e from excessive consumption of resources to the pollution of the surrounding environment (Ding, 2008). According to Kates (2003), human activities cause greenhouse gas emissions and global warming to increase whereas Tatari and Kucukvar (2011) have agreed with the fact that the buildings are one of the biggest contributors to greenhouse gas emissions being responsible for 38% of all CO<sub>2</sub> emissions. In order to

reduce or eliminate the impact on human health and the natural environment and increase the efficiency of use of energy, water and other resources, the movement of green (sustainable) building was found, which is expected to enhance the enjoyment of life of the occupants of green buildings (Richard, 2008).

For the purpose of enhancing the quality of green building construction by measuring its performance, a transparent evaluation process has also been established, which is called a 'Rating system' (Cole, 1999). The Leadership in Energy and Environmental Design (LEED) has been launched which encourages the adoption of sustainable green building and development practices. The Green Building Council of Sri Lanka (GBCSL) is uniquely supported by both the industry and government institutions across the country (GBCSL, 2011) which is quite similar to LEED.

After comparing with the conventional buildings, Kats (2003) has argued that green buildings are more efficient in terms of using resources whereas Richard (2003) has positively criticized that they are environmentally responsible and resource efficient throughout their life-cycles commencing from their siting to design, construction, operation, maintenance, renovation and deconstruction. Thus, green building has now become a leading mode of sustainable development in this century which has the ability for balancing long-term economic, environmental and social health. (Ali & Al Nsairat, 2009).

### **3. Transaction Costs in green buildings**

The actual cost of a construction project comprises of not only production costs but also transaction costs (Li, Arditi, & Wang, 2012). Production costs consist of direct expenses related to the building such as the costs related to material, equipment and construction labor whereas transaction costs consist of indirect expenses related to the building. Transaction costs relate to the cost of resources used to create and use a policy through defining, establishing, maintaining and transferring property rights (McCann (2005)). Moreover, Coggan, Whitten, and Bennett (2010) have mentioned that the transaction costs typically occur in the form of goods and services, travel costs, labour and time expended in a transaction whereas Alexia and Valerie (2008) have argued that they consist of all additional expenses related to a construction project such as the fees paid to the architect, engineer, consultant and the government, taxes, costs of financing and interest. Transaction costs are incorporated into the costs incurred at the pre contract stage (cost for carrying out market research, exploring financial opportunities, conducting a feasibility study, organizing bidding or negotiation and managing the designs) and post contract stage (costs for carrying out the administration of the contract, change orders and claims,

resolving of disputes and managing incentives) in construction projects. The transaction cost as a percentage of the total construction cost varies according to the procurement arrangements of a particular construction project (Whittington, 2008).

For this study, transaction cost is defined as the all the indirect cost which are incorporated in pre-contract stage as well as in post contract stage in a construction project i.e. cost for preliminary studies, designing costs, bidding costs, extra legal costs, administrative costs after contract, resolving disputes, inspection costs etc.

Green building transaction costs are higher than those of conventional buildings due to incremental costs associated with the process that has to be followed for obtaining a green building rating (Rehm & Ade, 2013) which involves additional consulting services, use of new technologies, processing of green certificates and risks connected with the innovative designs used (especially inexperienced contractors) (Alexia & Valerie, 2008). For instance, Langdon (2007) has analysed the Australian Green Star rating system by comparing the cost of the green and that of non-green buildings to estimate the cost premium where the green building has had a 3-5% premium with respect to their conventional counterparts. Likewise, Kats (2006) has found that the green design provided 1-2% additional cost with Packard Foundation (2002) indicating a 21% premium for LEED Platinum rated buildings.

#### **4.0 Research Problem**

Many international and local researches have been based on costs and benefits of green buildings, especially, their initial costs and the resulting benefits. This research was carried out on green office buildings in Sri Lanka since Colombo and other areas have a high demand for office buildings, even though their cost of maintenance is high. Brain (2003) has stated that if office buildings could be designed to reduce costs (especially their maintenance costs) and provide healthy and attractive buildings, tenants would be quite pleased with them as they were never before. Because of the reluctance to adopt new technologies and unwillingness to take financial risks, 'Green technology' is still a concept that is new when compared to conventional building construction. (Shirajiv, 2012).

As far as the literature gap and the industry gap are concerned, in Sri Lanka, a clear demarcation has not yet been identified between transaction cost of green office buildings and that of conventional buildings. Therefore, identifying and analysing the transaction costs of Green buildings vs. conventional buildings will have a significant effect on the research on

innovative methods of reducing the cost of green building construction in Sri Lanka.

### **5. Research Aim and Objectives**

The aim of the research study is to identify and analyse transaction costs of green buildings against conventional buildings in Sri Lanka. The objectives of the research study are as follows:

- To identify the Green building concept and its benefits
- To identify the components of transaction costs of Green buildings and conventional buildings
- To identify the transaction costs of Green buildings and conventional buildings
- To investigate the transaction costs in Green building vs. Conventional buildings

The study was conducted among professionals involved in the design, construction, and maintenance of at least one green building in Sri Lanka. To enhance the accuracy, both green and conventional office buildings having similar conditions and situated in Colombo region were considered.

### **7. Research Methodology**

The mixed method was adopted to undertake the research study while case studies were the research approach. Initially, an extensive literature survey and three preliminary unstructured expert interviews were carried out to understand the concept of green buildings and the benefits of the green buildings (objective 1) and the components of the transaction cost of both green and conventional buildings (objective 2). To identify the transaction costs of green and conventional buildings (objective 3), four case studies were done. Semi structured interviews were used for data collection and content analysis was the data analysis technique where the Nvivo 10 software was the analysis tool. The final objective; investigating the difference of transaction costs in Green buildings vs. conventional buildings was achieved through analysing the cost information attained from semi-structured interviews and document review.

### **8. Research Findings**

Research findings are discussed under three main headings (green buildings vs. conventional buildings), i.e identification of the transaction cost components, identification of the transaction costs and investigation the difference of transaction costs in Green buildings vs. conventional buildings.

### 8.1. IDENTIFICATION OF TRANSACTION COST COMPONENTS; GREEN OFFICE BUILDINGS VS. CONVENTIONAL BUILDINGS

The objective of this Section is to identify the transaction cost components of both green and conventional office buildings and the validation of the findings of the literature review. Three unstructured interviews were conducted for this purpose and Table 1 presents the profiles of the interviewees.

Table 1: Respondents' details of preliminary survey interviews

Profession	Position	Years of experience
Engineer	Project Manager	25 years
Quantity surveyor	General Manager	20 years
Engineer	Mechanical Engineer	7 years

The applicable transaction cost factors for both the pre-contract stage and the post contract stage were compared with the support of the experts. It was found that some cost components are similar while some others are higher for green buildings. Some factors were ignored as they were not applicable. The identified cost components are shown in Table 5 and those components were used to compare the transaction costs in Green office buildings against conventional buildings.

### 8.2. IDENTIFICATION OF TRANSACTION COSTS; GREEN OFFICE BUILDINGS VS. CONVENTIONAL BUILDINGS

The objective of this Section is to identify the transaction costs of both green and conventional office buildings. Four case studies were done to enable an in-depth investigation and Table 2 and 3 present respectively the details of the buildings and the details of the respondents.

Table 2: Brief details of the cases

Description	Green building (Part I)	Conventional building (Part I)	Green building (Part II)	Conventional building (Part II)
	CASE A1	CASE A2	CASE B1	CASE B2
Employer	Bank	Bank	Office	Office
Duration	1.5 Years	2 years	3 years	2 years
Contract sum	132 Million	150 Million	390 Million	340 Million
Number of	2 stories	3 stories	3 stories	4 stories
Completed	2012	2009	2009	2012
Floor area	10,000 sq. ft.	13,000 sq. ft.	100,000 sq. ft.	90,000 sq. ft.

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<b>Procurement method</b>	Measure and pay	Measure and pay	Measure and pay	Measure and pay
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Table 3: Details of respondents

	<b>Designation</b>	<b>Profession</b>	<b>Years of experience</b>
<b>Bank building</b>			
<b>Respondent 1</b>	Chartered Architect	Consultant	25
<b>Respondent 2</b>	Sustainable Engineer	Green consultant	10
<b>Respondent 3</b>	Civil engineer	Client	25
<b>Office building</b>			
<b>Respondent 4</b>	Chartered Architect	Consultant	20
<b>Respondent 5</b>	Sustainable Engineer	Green consultant	10
<b>Respondent 6</b>	Civil Engineer	Client	15

This study was mainly focused on comparing green buildings with conventional buildings. The green building in Case A1 was compared with the conventional building in Case A2 as was the case with the buildings in Case B1 and Case B2. The case analysis was carried in two steps: the first step to analyse the cost components based on the responses of the respondents and the second step to make the actual cost comparison using data obtained from the case studies.

### 8.2.1 Transaction Cost Components Comparison; Green vs. Conventional

Experts were asked to compare the transaction costs considering two stages; pre-contract stage and post contract stage. The identified factors (Refer table 5) through preliminary interviews was the basis of the comparison. Finally, it has to be accepted that the transaction cost of green buildings is higher than that of conventional buildings.

### 8.2.2 Actual Transaction Cost Comparison; Green vs. Conventional

For the actual comparison, cost data was used gathered from semi-structured interviews and the Table 5 gives the comparison of transaction costs for Case A1 and Case A2 as well as for Case B1 and Case B2. The highlighted sub-categories are for the incremental costs of green buildings under both scenarios. Meanwhile, Table 4 shows the most significant cost items for the increments of the transaction costs of green buildings which are feasibility study, preliminary estimation, sustainable design, cost for designing time, modelling cost, preparing tender document, drawing up a contract, gaining knowledge of materials and production, technical costs, commissioning and

documentation required for LEED certification, checking the quality of work at post contract stage as well as conducting inspection and preparing list of defects.

### 8.3 INVESTIGATION OF DIFFERENCE OF TRANSACTION COSTS IN GREEN BUILDINGS VS. CONVENTIONAL BUILDINGS

As shown in Table 4, the green coloured items are the incremental transaction costs whereas the yellow coloured items are the most significantly incremented transaction cost components. The reason for deducting the bidding cost of green buildings is the increment of the transaction cost due to commissioning for LEED certification and consultancy fees. However the bidding cost of green buildings is comparatively higher when compared with that of conventional buildings. The reason for the fluctuation of 'Gaining knowledge of materials and production' in Case B1 is because of its BMS system. On the whole, according to Table 4, green buildings have a higher percentage of transaction costs compared to conventional buildings which are significantly affected by the process required for commissioning for LEED certificate and its required documentation. However, the main intention of the client is to reduce the cost. When comparing the costs during pre-contract and post contract stages, cost for managing the designs of green buildings was more than what was required. It is an additional cost that was incurred due to lack of familiarity with green building construction. Thus with more and more green buildings being constructed and with more familiarity gained with their technologies, there will be a reduction of the transaction cost of green buildings.

Table 4: Cost comparison for significant cost items

Stage	Most significant cost item	Case A1	Case A2	Case B1	Case B2
<b>Pre-Contract Stage</b>	Preliminary studies	20.94%	20%	20.57 %	20%
	Managing Design	19.91%	10%	14%	10%
	Bidding cost	17.16%	25%	20.15%	25%
	Gaining knowledge of materials and production	4.8%	5%	5.94%	5%
	Acquiring and processing information	4.8%	5%	4.88%	5%
	Technical	2.95%	2%	3.65%	2%
	Commissioning required for LEED	3.90%	-	2.44%	-
	The documentation for LEED	1.72%	-	2.12%	-
<b>Post Contract Stage</b>	Check the quality of work	7.04%	10 %	8.17%	10 %
	Carrying inspection and preparing list of defects	1.78%	1.50%	1.68%	1.50%
<b>Total Transaction costs</b>		9.71%	5.5%	7.20%	5.5%



## **9.0 Conclusion and recommendations**

The negative impact of green buildings is less on the environment and these buildings have benefits in terms of environmental, economic and social factors. At present, there is a high demand in Sri Lanka for office buildings, especially in Colombo. Therefore it becomes necessary to identify the transaction cost of green office buildings.

The preliminary study, managing cost, bidding cost, drawing up of a contract, value engineering, geotechnical testing, environmental studies, acquiring and processing of information, modelling costs, gaining knowledge of materials and production and external costs have been identified as the transaction cost components in the pre-contract stage of a green building construction, whereas the administering of the contract, checking the quality of work, administering change orders and claims, resolving disputes, handing over and issuing of the final certification, and carrying out inspections and preparing a list of defects are the cost components identified as related to the post contract stage.

From the in-depth analysis of the four case studies, it was revealed that the transaction cost component of green office buildings is higher when compared to that of conventional buildings.

Table 5: Actual Transaction Cost Comparison

Stage		Green Building	Conventional Building	Green Building	Conventional Building
		Part I		Part II	
		Case A1	Case A2	Case B1	Case B2
Pre-Contract Stage	<b>Contract sum</b>	132,000,000.00	150,000,000.00	370,000,000.00	340,000,000.00
	<b>Total Transaction Cost</b>	12,820,000.00	8,250,000.00	26,650,000.00	18,700,000.00
	<b>Preliminary Studies</b>	2,684,000.00	1,650,000.00	5,482,500.00	3,740,000.00
	Feasibility Study	1,254,000.00	618,750.00	2,091,250.00	1,402,500.00
	Preliminary Design	1,034,000.00	618,750.00	2,373,750.00	1,402,500.00
	Preliminary Estimation	396,000.00	412,500.00	1,017,500.00	935,000.00
	<b>Managing Design</b>	2,552,000.00	825,000.00	3,730,000.00	1,870,000.00
	Sustainable Design	1,786,400.00	577,500.00	1,424,500.00	1,309,000.00
	Architectural and Engineering (A&E) Design Time	382,800.00	123,750.00	305,250.00	280,500.00
	Modelling Costs	382,800.00	123,750.00	305,250.00	280,500.00
	<b>Bidding Cost</b>	2,200,000.00	2,062,500.00	5,370,000.00	4,675,000.00
	Preparing a Tender Document	1,012,000.00	825,000.00	2,317,500.00	1,870,000.00
	Estimating	792,000.00	825,000.00	2,035,000.00	1,870,000.00
	Local Authority Approval	396,000.00	412,500.00	1,017,500.00	935,000.00
	<b>Drawing up a contract</b>	616,000.00	412,500.00	1,017,500.00	935,000.00
	Accepting Bids and Making an Award	369,600.00	247,500.00	610,500.00	561,000.00
	Concluding Contracts	246,400.00	165,000.00	407,000.00	374,000.00
	<b>Gaining Knowledge of Material and Production</b>	616,000.00	412,500.00	1,582,500.00	935,000.00
	<b>Environmental Studies</b>	616,000.00	412,500.00	1,300,000.00	935,000.00
	Acquiring and Processing of Information	616,000.00	412,500.00	1,300,000.00	935,000.00
	<b>External Costs</b>	1,336,000.00	412,500.00	2,797,500.00	935,000.00

	Legal	118,800.00	123,750.00	305,250.00	280,500.00
	Technical	497,200.00	288,750.00	1,277,250.00	654,500.00
	Commissioning required for LEED	500,000.00	-	650,000.00	-
	Documentation for LEED	220,000.00	-	565,000.00	-
<b>Post Contract Stage</b>	<b>Total Post Contract Transaction Cost</b>	<b>2,200,000.00</b>	<b>2,062,500.00</b>	<b>5,370,000.00</b>	<b>4,675,000.00</b>
	Administering of the Contract	792,000.00	825,000.00	2,035,000.00	1,870,000.00
	Check the quality of work	902,000.00	825,000.00	2,176,250.00	1,870,000.00
	Administering of Change Orders and Claims	79,200.00	82,500.00	203,500.00	187,000.00
	Resolving of Disputes	39,600.00	41,250.00	101,750.00	93,500.00
	Handing Over and Issuing of Final Certification	158,400.00	165,000.00	407,000.00	374,000.00
	Conducting Inspections and Preparing the List of Defects	228,800.00	123,750.00	446,500.00	280,500.00

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The most significant reasons for this are the process that has to be followed for the commissioning required for LEED certificate and its required documentation. The lack of familiarity with green building construction is also a reason for the increment of the transaction cost. It can be recommended that becoming familiar with the green concept by stakeholders of the construction industry and increasing the rate of green building construction would reduce the transaction costs of green buildings. Most importantly, reducing the cost of Green Certification would provide considerable relief to clients in the industry. Furthermore, regulatory bodies are invited to increase the affordability of green material by minimizing the taxes imposed on the imported material. It will be rewarding to the professionals who are involved in the construction of green buildings, if they could be recognized officially. Organizing of seminars to promote the green concept among the younger generation will also add a value to the industry.

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