PROJECT RISK MANAGEMENT BY SMALL-SCALE CONTRACTORS IN SRI LANKAN BUILDING CONSTRUCTION

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ABSTRACT

The construction industry remains one of the most dynamic and challenging industries in the world due to the complexity of its production process. This makes it subject to more risk and uncertainty than other industries that make it difficult for newcomers as well as small-scale contractors to be sustainable in the construction industry. The identification and assessment of new risks along with their interrelationships and coming up with the appropriate responses to new risks is a cumbersome process entailing some degree of complexity. The present research focuses on the identification of critical risks, the allocation of those risks among the small scale contracting parties, and the determination of appropriate response measures to managing the risks thus identified.

The study first elicited the views of senior construction professionals on risks in the small-scale contractors in a preliminary survey prior to carrying out a questionnaire survey among a selected group of small-scale contractors. Sixteen (16) significant risk factors were identified and evaluated by using the Relative Importance Index (RII). The research further worked out the allocation of risk among the contracting parties and the appropriate response measures. On the basis of the research outcomes, the study proposes a risk management framework for appropriate risk management among small-scale contractors. The findings reveal the importance of paying attention to risk aspects by small-scale contractors in construction projects and identifying the problems relating to inadequate knowledge or techniques of small-scale contractors that may pose barriers to it. The paper proposes proper education and training of such contractors as one measure to overcome the identified barriers. It recommends the hiring of risk management consultants and the bearing of the risk by the party that has most control over it rather than passing it on to the other party as ways to control risks.

Keywords: *Response Measures; Risk Management; Significant Risk Factors; Small-Scale Contractors; Sri Lankan Building Construction Industry.*

1. INTRODUCTION

There is a significant demand for condominiums in Colombo metropolitan area due to high population density, scarcity of land availability and soaring prices of property particularly in urban areas of the country (Gunawardena and Samarajeewa, 2006) and convenience of buying a condominium rather than constructing a house (Senaratne *et al.*, 2006). Hewamanna (2005) identified that there is a rapid expansion in the construction and sale of condominiums in Sri Lanka during the past few decades. Especially in Colombo and suburbs, the apartment market is mainly vigorous because there is a huge demand for urban living (Wasala, 2007). However, in long-term sustainability of this industry would, certainly, depend on the ability of the property developers to meet the needs and expectations of the end users or the occupants (Gunawardena and Samarajeewa, 2005). Kerti (2014) sated that construction of apartment or condominium is a means of supporting the development options tourism in tourist destination areas which have limited land for construction of tourism facilities. According to the Apartment Ownership Law Act No. 39 of 2003, condominium is a property comprising of land with a building or buildings more than one story and having more than one unit residential or non-residential accommodation.

The population of a country can be generally in three groups according to the income levels as high, medium and low (Central Bank, 2009). The residential sector of Sri Lanka is a major area that shows variations

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according to the above three levels. Types of the condominium available in Sri Lanka mainly depend on facilities offered such as swimming pool, gymnasium, restaurant and internal and external finishes and fittings used. (Senaratne *et al*., 2006). As Wijeyeweere (2004) mentioned, based on the available facilities, finishes and fittings, condominiums can be categorised in to super luxury, luxury, semi luxury and the utility condominiums. The government is the main developer for utility condominiums in Sri Lanka. Therefore, government servants, low-income earners and the shanty dwellers have been the beneficiaries of such state sponsored projects. Siriwardena (2001) stated that low income condominiums have become the most viable alternate homeownership method to provide accommodation for low income earners and resettlement of shanty dwellers with the upsurge of land values in urban areas. Even though living in these condominiums provide many benefits for low income groups in the society, as found by Lorensuhewa (2009) various issues existed with the low income community in Sri Lanka. According to the findings of Gunawardena and Samarajeewa (2005), significant differences could be seen between the expectations of occupants in condominium and understanding of the developers. As stated by the same authors, this situation is more worsen in the public sector condominium developments. Gunawardana and Samarajeewa (2006) pointed out that occupant satisfaction is very significant for the progress and existence of the condominium industry. Therefore, identifying the issues in condominiums designed is essential to provide better living environment for the users although few research studies conducted in the particular area. Thus, this study investigates the existing living condition of low income condominiums in Sri Lanka in terms of user satisfaction. This study was limited to the low income condominiums which are located in the Colombo district. The construction industry constitutes a key component in a nation's economy and affects by the Gross Domestic Product (GDP) of any country (Enshassi, Al-Hallaq, and Mohamed, 2006). Moreover, it is one of the most dynamic, risky, and challenging businesses (Mills, 2001). Because construction projects are commenced in complex, dynamic and uncertain environments, they are prone to many types of risks (Baloi and Price, 2003), which inevitably affect the cost, time and quality of the construction project.

Risk is defined as exposure to the possibility of economic or financial loss or gains, and the physical damage or injury or delay as a consequence of the uncertainty associated with pursuing a course of action" (Chapman and Cooper, 1987, p.238). Risk and uncertainty can potentially carry negative consequences for some construction projects (Burchett, Tummala, and Leung, 1999). Furthermore, it can affect productivity, quality, performance, and the project budget. However, Burchett, Tummala, and Leung (1999) have asserted that risk can be minimised, though it is inherent and difficult to treat, if an appropriate management framework can be arrived at informed by both a theoretical and practical sense (Wang, Dulami, and Aguria, 2004).

Risk management is an essential part of the decision making of construction firms according to Liu, Flanagan, and Li (2003). They go on to say that risk management creates awareness of uncertainty, risk qualification, controllable risk management and of how to minimise the impact of uncontrollable risk by risk allocation/apportionment. Jaafari and Anderson (1995) list three steps to risk management: identification and analysis of the risk, and response to the risk. Flanagan and Norman (1993) asserted that risk identification is a key stage in risk management as risks cannot be managed unless identified. Identifying each source of risk and their components allows the risk element to be separated and distinguished from others (Bajaj, Oluwoye, and Lenard, 1997). According to these authors, consideration of factors influencing each risk will simplify its analysis and management. The next step in risk management is the analysis of associated risks where the effects of major risks that have been identified are first quantified and then analysed in order to determine both the impact and probability of each risk (Mills, 2001). The final step in risk management is risk response planning which is a process of determining the appropriate responses to the risks that are screened and analysed quantitatively (Schatteman, Herroelen, and Vonder, 2008). These authors have further argued that upon identifying probability of exposure to a particular risk and quantifying its impending consequences, the next step is to deploy acknowledged appropriate strategies such as risk probability reduction, risk avoidance, risk impact reduction and risk transfer. For Quayle (1999), therefore, risk and uncertainty are inherent in all construction work no matter what the size of the project though the size of the project is a key indicator in the categorization of contractors.

Distinctions can be made between contractors on the basis of variables such as the size of the annual turnover, capacity, and capability (Dlungwana and Rwelamila, 2003). A small-scale contractor is generally defined as someone with limited capital for investment, who may need financial and managerial support to effectively run his or her business (Sibanda, 1999). However, industry professionals highlighted the

importance of creating an enabling environment for small-scale contractors which includes the removal of barriers to their market entry and for their growth and sustainability. Part of the enabling process may be to offer small-scale contractors support, which will facilitate access to essential resources for them to start and sustain their businesses (Sibanda, 1999). Many small-scale contractors experience difficulties in obtaining funds from financial institutions to finance their business due to the high levels of bankruptcy in the industry(Miles, 1979).Though the initial capital for the business must come from the contractor, many small-scale contractors experience difficulties in obtaining funds from financial institutions to finance their business due to the high levels of bankruptcy in the industry(Miles, 1979).In addition, a majority of small-scale contractors in developing countries have very limited funds and are therefore seldom able to provide the necessary fixed assets as guarantees (Ofori, 1991). Since small-scale contractors operate on very tight budgets, when they make a loss on one project, they tend not to have sufficient resources to continue in business, thus paving the way towards high risks to small-scale contractors in the business (Stretton, 1984).

The risks faced by small-scale contractors in the construction industry are many and varied such as financial risk, managerial risk, technical risk, and political risk. Small- to medium-scale businesses are exposed to risks all the time where they may directly affect day-to-day operations and decrease revenue or increase expenses, the impacts of the said risks ultimately being severe enough to result in failure in the business (CPA Australia Ltd, 2009). However, Sri Lankan small-scale contractors are said to face similar challenges in the short term as they struggle to sustain themselves in the construction industry due to managerial inadequacy, inefficiency, incompetence and inexperience. This makes it difficult for small-scale contractors to secure new opportunities in the industry. There is therefore a need to properly manage risk in order to achieve stability and success in the long run for local small-scale contractors. The present study identifies the risks and risk management strategies for small-scale construction in Sri Lanka and develops a risk management framework to mitigate risk that will result in successful operation of the business in current practice.

2. RISKS MANAGEMENT BY SMALL-SCALE CONTRACTORS: LITERATURE REVIEW

2.1. IDENTIFICATION OF RISKS FACED BY SMALL-SCALE CONTRACTORS

Risk identification is the first step in risk management process (Andi, 2006; Ling and Hoi, 2006; Kayis and Amornsawadwatana, 2007). According Wang and Chou (2003) and Marques and Berg (2011), risk identification and risk allocation are influential factors in risk management while Hertz and Thomas (1984) define risk identification as risk diagnosis. Thus, Heldman (2005) sees the risk identification process as involving the identification and documentation of all the potential risks that might impact the project and their characteristics. Following sections identify imperative risks in building construction.

2.1.1. FINANCIAL RISK

Dada and Jagboro (2007) identified finance as one of the main risk factors faced by small-scale contractors. Edwards and Bowen (1998) categorized it as capital supply, interest rates, credit ratings, cash flows and rentals. Many small contractors experience difficulties in obtaining loans from financial institutions to finance their business due to the high levels of bankruptcy in the industry, which means that the initial capital for the business must come from the contractor (Miles, 1979). In addition, most small and medium contractors in developing countries have very limited funds and they are seldom able to offer the necessary fixed assets as collateral (Ofori, 1991). Since small contractors operate on very tight budgets, when they make a loss on one project, they tend not to have sufficient resources to continue in business (Stretton, 1984).

2.1.2. LEGAL RISK

The legal risk, as categorised by Edwards and Bowen (1998), has to do with contract clauses, regulations and codes. According to Tchankova (2002), the legal system imposes a risk because of contract flaws that may result in breaking current or new local laws relating to the environment. Han and Diekmann (2001) and Wang, Dulaimi, Fadhil, Qing and Yousuf (2004) have identified laws relating to environmental protection, changes in such laws, law enforcement, different codes and contract clauses, and differences of opinion with regard to dispute resolution as the legal risks faced by small-scale contractors.

2.1.3. TECHNICAL RISK

Manelele and Muya (2008) argued that lack of technical advice was one of the risks in project initiation where design changes and construction methods are the major risks factors. Edwards and Bowen (1998) included design failure, equipment and systems failure, estimation error, and collisions and accidents among the technical risks. The findings of a study by Santoso, Ogunlana and Minato, (2003) have endorsed the aforementioned technical risks.

2.1.4. POLITICAL RISK

According to Lester, (2007), internal politics are an inherent feature of all organisations which may result in differences of opinion and attitudes among the different stakeholders. Tchankova (2002) highlighted how the ruling party of a nation can affect organisations in many ways because of differences in attitudes and policies towards businesses. Thus, Harinarain, Othman and Pearl (2008) identified government authorities as a source of risk to contractors with changes in government and government policies carrying the potential to adversely affect the success of the project.

2.1.5. MANAGERIAL RISK

According to International Labour Organisation (ILO, 1987), defficiency in planning and management skills is said to be one of the biggest problems for small-scale contractors. In developing countries in particular, the local construction industry lacks the capacity and capability to undertake large construction projects, which results in the continual domination of expatriate construction companies in all major construction projects of such countries. Consequently, smaller companies find it hard to acquire experience in their chosen type of project (Jannadi, 1997), thus perpetuating a situation of local contractors who continue to have limited management and technical skills (Ofori, 1991) that negatively influence their chances at bidding(Stretton, 1984) and, performance (Ofori, 1991). This in turn impacts the skills and experience of young graduates working in the industry" (Lewis, 1984).

2.1.6. COMMUNICATION RISK

Though communication among management and staff in small firms tends to be good, sometimes the poor communication skills of the manager can pose a problem for cordial relations between management and staff (Fryer cited in Wasi, Bridge, and Skitmore, 2001). There is often no means of communication between the workers on site and the contractor's office. Urgent site problems, therefore, cannot be solved immediately The ILO (1987) has further noted that the level of supervision by the client too can affect the performance of the contractor. Thus, if the client supervisor is not qualified, or where there is no effective communication between the contractor and the client, this may result in the contractor doing remedial work, which can be very costly for small contractors reducing profit margins and putting a strain on cash flow.

It is clear that risk identification is an important process that identifies the severe risks in a project. In addition, the risk identification process should highlight significant risks, which should be selected for further analysis (Adams, 2008).

2.2. RISK ANALYSIS AND RESPONSE

Risk analysis is the vital link between risk identification and risk response (Al-Bahar and Crandall, 1990). Risk analysis is defined as the evaluation of the impact of the risk to the project (Wang, Dulaimi, and Aguria, 2004) while as the next step, Akintoye and Macleod (1997) identify risk response as risk allocation. A risk shall be allocated to a particular party, which has the competence and expertise necessary to assess the risk fairly in order to control or minimise the same (Fisk, 1997). Andi (2006) however claims that, risks can merely be transferred or shared from one party to another through contract clauses. Once the risks of a project have been identified and analysed, it will enable the stakeholders to adopt appropriate risk response strategies to cope with the identified risks. Fan *et al.* (2008) have stated that risk response identifies, evaluates, selects and implements strategies in order to reduce the likelihood of occurrence of risk events and/or to lower the negative impact of those risks to an acceptable level.

2.3. SIGNIFICANCE OF RISK MANAGEMENT FOR SMALL-SCALE CONTRACTORS IN SRI LANKA

Satisfaction is referred to as a criterion for evaluating the quality of the residential environment by measuring the effect of perception and assessments of the objective environment upon satisfaction (Altaq and Gzsoy, 1998). As Choudhury (1997) stated residential satisfaction in an apartment is a measure of the capability of the living environment as evaluated by the occupants. It is documented several methods can be used to identify or measure the occupants satisfaction such as formal marketing research, through experience, feedback on the completed projects (Liu, 1999; Ozaki, 2003). Post-occupancy evaluation (POE) is a platform for the systematic study of buildings once occupied, so that lessons may be learned that will improve their current conditions and guide the design of future buildings. Yirga (2012) mentioned that post occupancy management is one of the most pressing challenges with the condominiums as most of the design principles are not well configured and practiced. However, most of property developers seem reluctant to spend much time carrying out such evaluation after a project has been finished. As Gunawardena and Samarajeewa (2006) emphasised, the sustainability of any product lies in its ability to satisfy customer needs continuously. Thus, conducting surveys to identify occupants' satisfaction in condominium life is essential for sustain the properties for a long time. The literature review makes it evident that extensive research has been undertaken in the field of risk management for construction projects. Though studies that focus on some aspects of risk management are available, there is a dearth of research that undertakes a comprehensive assessment of risk management in small-scale construction. However, it is noteworthy that small-scale contractors are higher in number than large-scale contractors in developing countries such as Sri Lanka which make it difficult to discount their contribution to economic growth and makes it imperative. Though Wasi, Bridge, and Skitmore, (2001) and Thwala and Mvubu (2008) have studied the challenges and problems facing small-scale construction in other countries, the findings do not quite suit the Sri Lankan construction industry due to the distinctive character of the construction industry in Sri Lanka. In addition, the afore-mentioned studies do not offer clear-cut explanations of risk in small-scale construction and do not clearly establish risk management by small-scale contractors. However, their findings can be used to guide the present research which studies risk management practices in the Sri Lankan construction industry. Developing countries like Sri Lanka need better managerial tools to manage risk, especially in small-scale construction. Thus, the present study aims to identify and evaluate risk management in small-scale construction in the Sri Lankan construction industry.

3. METHODOLOGY

A comprehensive literature review was carried out to configure the background to the research problem and to prepare the preliminary survey guide line. The literature categorised the risk factors into groups under financial risk, legal risk, technology risk, political risk, managerial risk and communication risk using 23 risk factors. Perera, Rathnayake and Rameezdeen (2008) identified some risk response techniques, barriers to their implementation and solutions to overcome the barriers in road construction projects within Sri Lanka which helped frame the preliminary survey guideline of the research. A questionnaire survey was used for preliminary data collection and was conducted with 3 experts from the industry who have more than 20 years of working experience in order to validate the information gathered from literature to the Sri Lankan context. The preliminary survey added 7 new risk factors to the list while 3 were removed from the documented risk factors gathered from the literature review because they were found not to be relevant to small-scale contractors in Sri Lanka (refer Table 1). ICTAD registration, new construction technology, less professional involvement, shortage of labour, and increasing competition in the industry were added to the list taking into consideration the inherent problems faced by small-scale contractors in Sri Lanka. Of the 42 numbers of questionnaires distributed to small-scale contractors in the survey, 36 completed questionnaires were returned to the researchers.

Table 1: Identified Risk Factors

1.0 Financial Risk	2.0 Legal Risk	3.0 Technical Risk
Capital supply	Environmental protection	Design failure/changes
Interest rates	Change in law	Estimation errors
Credit ratings	Law enforcement	Collisions and accidents
Cash flows	Different codes and contract clauses	Material availability
Rentals	Different dispute resolution methods	Equipment availability
Increasing competition	ICTAD registration	Construction process/method
	Occupational health/safety	Construction site
		Ground conditions
		New construction technology
4.0 Political Risk	**5.0 Managerial Risk**	**6.0 Communication Risk**
Change of government	Lack of managerial skills	Effective communication between the contractor and the client
Change of government policy	Low construction productivity	Poor communication (language problem)
Regulations	Less professional involvement	
Demand of bribe or commission by politician	Shortage of labour	

- Added to list **-** Removed from list

The questionnaire elicited information on the frequency of occurrence and impact of identified risk factors of small-scale construction projects by using the 1-5 Likert scale. Furthermore, it focused on the allocation of small-scale construction risk factors in order to find out whether the risk factors are allotted to contractors or to clients and to discover the percentage in terms of allocation of risk factors to each party. Moreover, it covered the appropriate response measures commonly used in the construction industry and the suitability of application of those measures in the Sri Lankan construction industry. The questionnaire focused lastly on the barriers to the risk management process and solutions to the barriers. Subsequently, the Relative Importanceindex techinique was selected for the data anlysis using the following equations:

$$\text{Relative Importance Index (RII)} = \frac{\sum w}{AN} \qquad \text{(Eq: 01)}$$

Where, w is the weighting given to each factor by the respondents, ranging from 1 to 5, *A* is the highest weight (i.e., 5 in the study) and *N* is the total number of samples.

Reliability testing is important for any research of this nature. Hence, Cronbach's alpha method is used to check the reliability of the data set which is expressed by a number between 0 and 1 (Tavakol and Dennick, 2011) and measures how each individual element in a scale correlates with the sum of the remaining points.

4. ANALYSIS AND FINDINGS

4.1. SIGNIFICANT RISK FACTORS

The questionnaire gathered data the frequency of occurrence (likelihood) of risk factors and their impact on the objectives of projects. For the analysis, the significant risk factors were identified and both their frequency of occurrence and impact on the objectives of projects were considered. Since a rating value is necessary for identifying the momentous risks in small-scale construction projects, the collected data from the questionnaire was analysed in three stages as follows:

- Calculation of Relative Importance Index (RII) of likelihood of identified risks;
- Calculation of Relative Importance Index (RII) of impact of those factors;
- Multiplication of the above indexes to get the rating value.

Factors which fulfil the following three requirements were identified as significant risk factors:

- With a rating value of 0.360 or above (Sun, Fang, Wang, Dai, and Ly, 2008; Zhu, 2007);
- With 0.6 or above for the level of frequency of risk occurrence (since the rating is 1-5, Point 3 is considered the neutral point);
- With 0.6 or above for the significance of risk impact (since the rating is 1-5, Point 3 is considered the neutral point).

In order to analyse the significance of factors, the risk factors in each category were filtered by applying the rating value with some factors being excluded which obtained less than 0.360 as the rating value. Table 2 presents the significant risk factors in each category.

Table 2: Ranking of Risk Factors by Significance Levels

Risk Factors	Occurrence RII	Impact RII	Rating Value	Rank	Overall Rank
Financial Risk					
Cash flows	0.856	0.844	0.722	1	1
Capital supply	0.806	0.867	0.698	2	2
Increasing competition	0.739	0.822	0.608	3	6
Legal Risk					
Occupational health/ safety	0.789	0.700	0.552	1	9
Change in law	0.617	0.744	0.459	2	15
Technical Risk					
Equipment availability	0.806	0.794	0.640	1	3
Material availability	0.817	0.772	0.631	2	4
Estimation errors	0.733	0.772	0.566	3	8
Collisions and accidents	0.739	0.706	0.521	4	11
New construction technology	0.689	0.728	0.501	5	12
Design failure/ changes	0.628	0.650	0.408	6	16
Political Risk					
Demand of bribe by politician	0.728	0.683	0.497	1	13
Change of government policy	0.694	0.706	0.490	2	14
Regulations	0.533	0.650	0.347	3	20
Managerial Risk					
Shortage of labour	0.822	0.744	0.612	1	5
Lack of managerial skills	0.744	0.761	0.567	2	7
Less professional involvement	0.728	0.722	0.526	3	10

4.2. RISK ALLOCATION

Using the results, the RII for the allocation of each risk factor was calculated in order to find the percentage of allocation to contractor and client on the basis of which a determination was made whether the risk is allotted to the contractor or client. Table 2 displays the percentage of allocation of each risk factor to the two parties in small-scale construction contracts and the importance of proper risk allocation for the contractor and client/ consultant. However, as risk cannot be handled by one party in some instances, risk responsibility is sometimes shared by both parties. The general principle is that risk is allocated to the party that can handle it or the party that has control over it. According to experts, risk is allocated to the afore-mentioned two parties as seen in Table 2.

4.3. RISK RESPONSE

The appropriate risk response measures for significant risk factors in each category were identified through the questionnaire survey in which respondents were requested to point out the appropriate response methods for each risk factor based on their knowledge and experience in the industry. The response measures, which were identified through the preliminary survey, were ranked according to the percentage of usage of those measures in small-scale construction projects as shown in Table 2.

4.4. PROPOSED RISK HANDLING FRAMEWORK

Having identified the risk factors, the risk allocation and the handling of such risks in small-scale construction projects, a risk management framework was developed as demonstrated in Table 4. In developing this framework, the risk factors were categorised into six groups initially, the factors being adopted from both the literature review and actual data collection from industry from interviews with industry professionals. Table 3 presents the barrier codes and solutions codes used for the Frame work.

Table 3: Model on Barriers and Solutions to Risk Management

Barrier Code	Barriers to Risk Management	Solution Code	Solutions to Risk Management
B1	Lack of joint risk management mechanisms by parties	**S1**	Hiring risk management consultants
B2	Lack of formal risk management system	**S2**	Recruiting a specialist
B3	Additional cost for risk management	**S3**	Developing a suitable risk management system
B4	No proper mechanism	**S4**	Maintaining proper record-keeping system
B5	Inadequate knowledge/techniques on risk management	**S5**	Education and training regarding techniques on risk management
B6	Ineffective implementation of risk control strategies	**S6**	Developing communication skills
B7	Ineffective monitoring		
B8	Lack of qualified professionals		

Table 4: Risk Handling Framework for Small-scale Contractors

Risk Factors	Allocation		Response Measures	Barriers	Solutions
	Client	Contractor			
Significant Financial Risks					
Cash flows	40%	60%	1. Pre-contract negotiations as to which party will bear which risks	B1, B2. B3, B4	S1, S2, S3
			2. Claiming for damages	B5, B6, B7	S1, S2, S4
			3. Expert judgment	B7, B8	S2
Capital Supply	64%	36%	1. Pre-contract negotiations as to which party will shoulder which risks	B1, B2. B3, B4	S1, S2, S3
			2. Transferring risk to insurance company	B3, B4, B7	S1, S2, S5
			3. Allocation of contingency plan	B1, B2. B3, B4	S2, S5
Increasing Competition	31%	69%	1. Education and training	B5, B8	S5
			2. Expert judgment	B7, B8	S2
Significant Political Risks					
Demand of commission or bribe by Politician	46%	54%	1. Pre-contract negotiations as to which party bears which risks	B1, B2. B3, B4	S1, S2, S3
			2. Teamwork culture	B4, B7	S5, S6
Change in Government Policy	55%	45%	1. Education and training	B5, B8	S5
			2. Expert opinion	B7, B8	S2
Significant Technical Risk					
Equipment Availability	38%	62%	1. Pre-contract negotiations as to which party bears which risks	B1, B2, B3, B4	S1, S2, S3
			2. Allocation of contingency plan	B2, B4, B5	S2, S5
			3. Education and training	B5, B8	S5
Material Availability	40%	60%	1. Pre-contract negotiations as to which party bears which risks	B1, B2, B3, B4	S1, S2, S3
			2. Allocation of contingency plan	B2, B4, B5	S2, S5
			3. Education and Training	B5, B8	S5
Estimation Errors	44%	56%	1. Pre-contract negotiations as to which party bears which risks	B1, B2. B3, B4	S1, S2, S3
			2. Transferring risk to insurance company	B3, B4, B7	S1, S2, S5
			3. Claiming for damages	B5, B6, B7	S1, S2, S4
			4. Brainstorming to identify new risks	B3, B5	S3, S6
Collisions and Accidents	42%	58%	1. Transferring risk to insurance company	B3, B4, B7	S1, S2, S5
			2. Claiming for damages	B5, B6, B7	S1, S2, S4

Risk Factors	Allocation		Response Measures	Barriers	Solutions
	Client	Contractor			
			3. Allocation of contingency plan	B2, B5	S2, S5
New Construction Technology	35%	65%	1. Allocation of contingency plan	B1, B2. B3, B4	S2, S5
			2. Education and Training	B5, B8	S5
Risk Factors	**Allocation**		**Response Measures**	**Barriers**	**Solutions**
	Client	**Contractor**			
Design Failure/ Changes	55%	45%	1. Pre-contract negotiations as to which party bears which risks	B1, B2, B3, B4	S1, S2, S3
			2. Transferring risk to insurance company	B3, B4, B7	S1, S2, S5
			3. Claiming for damages	B5, B6, B7	S1, S2, S4
Significant Managerial Risk					
Shortage of Labour	30%	70%	1. Education and Training	B5, B8	S5
			2. Brainstorming to identify new risks	B3, B5	S3, S6
			3. Team work culture	B4, B7	S5, S6
Lack of Managerial Skills	34%	66%	1. Education and Training	B5, B8	S5
			2. Team work culture	B4, B7	S5, S6
Less Professional Involvement	39%	61%	1. Education and Training	B5, B8	S5
			2. Team work culture	B4, B7	S5, S6
Significant Legal Risk					
Occupational Health/ Safety.	44%	56%	1. Education and training	B5, B8	S5
			2. Physical protection to reduce the likelihood of risk	B3, B7	S5, S6
			3. Physical protection for people and property	B3, B7	S1, S5
Change in Law	56%	44%	1. Pre-contract negotiations as to which party bears which risk	B1, B3, B4	S1, S2, S3
			2. Allocation of contingency plan	B2, B3, B5	S2, S5
			3. Education and training	B5, B8	S5
			4. Expert judgment	B7, B8	S2

In this framework (refer Table 4), the first column represents the most significant risk factors in each category while the second column deals with the percentage of allocation of identified risk factors to the two parties in the contract. The appropriate response measures to small-scale construction risks are shown in the third column while the last two columns specify the barriers with regard to the implementation of response measures in the risk management process and the possible solutions to overcome those barriers.

The framework shows that small-scale construction projects consistently face the afore-mentioned risks at different stages of the project. Since all identified risk factors cannot be eliminated completely, it would be better to be remaining alert to the occurrence of such risks and their impacts on the projects via reference to this framework. The framework further reveals the allocation, response measures, barriers and solutions with regard to risk factors that small-scale contractors should have a proper understanding of. However, it is best that both parties to the contract handle the identified risks by showing proper concern towards them despite challenges in the way of risk management in small-scale construction projects. The percentage amount of allocation of each risk factor to each of the two parties is given in detail in this framework. It shows that it is wiser in small-scale construction industry for the party that can control the risk to take responsibility for it rather than passing the risk to the other party. The framework contains the appropriate response measures for the identified risk factors which clearly demonstrate ways to mitigate each risk as soon as it is encountered in the field. Further, the barriers listed make it possible for those in the small-scale sectors to identify them early so as to properly plan for them in advance and thus mitigate the stress associated when obstacles appear of a sudden. The framework further offers solutions to overcome the barriers identified with regard to each risk factor in detail which gives proper guidance in risk management to parties in the field of small-scale construction.

5. CONCLUSIONS

The ccompletion of a construction project within the allocated budget, time and required quality is becoming a major concern due to the cost overruns, time delays and poor quality of countless projects in Sri Lanka. The completion of small-scale construction projects is additionally affected by financial, legal, technical, political, managerial and communication risk factors that are peculiar to them. Therefore, a critical understanding of risk management has become of vital importance for Sri Lankan small-scale contractors. With the objective to identify and classify the risk factors associated with small-scale construction projects and to see how they are handled by the contracting parties, in mind, the study initially identified the significant risks in small-scale construction. Having evaluated the allocation of significant risk factors to each risk category, they were analysed in order to determine which of the two contracting parties involved in small-scale construction projects should bear a particular risk. The study further derived the available risk response techniques for the above significant risk factors. In addition, it identified the barriers in the way of implementing the response measures as well as the solutions to overcoming those barriers as proposed in the Table 5. The accomplishment of the ultimate objective of this research, which was to provide a framework of risk management for small-scale contractors in building projects in Sri Lanka, was possible based on the findings of the questionnaire survey and literature survey. The framework specified that the sharing responsibilities among the parties involved in a construction project is necessary as assigning overall responsibility to one party carries some element of danger and would incur more cost should the perceived risky situation were to occur. Hence, it is customary to shift the responsibility for the risk to either the contractor or the client and sometimes to share it among both parties.

6. RECOMMENDATIONS

The findings of this research deserve attention because they highlight the different types of risks that small-scale construction projects consistently face in different stages of the project. Small-scale construction projects are affected by several critical and severe risk factors, which are both unforeseeable as well as unavoidable by the parties contracted under the project. However, risk management in small-scale construction projects is crucial for completion of the projects within the allocated budget, time and required quality. Since risk factors cannot be eliminated completely, it would be better to minimise their occurrence and their impact on the project objectives by adopting proper response measures from the inception of the project with better interaction among the contracting parties

There is no doubt that risks directly affect the construction process leading to both delays and cost increases for both clients and contractors. Hence, it is a good practice for both parties to show concern for and handle risk despite the challenges posed for risk management in small-scale construction. Further, it is best for all concerned in the small-scale construction industry for the party that is better able to control to bear it rather than passing it onto the other party. The researchers further recommend that the framework developed in the present study be utilised at the initial stages of the project since it includes the significant risks, their allocation to the contracting parties, the response measures that could be implemented to deal with the risk factors, the barriers in the way of such implementation and solutions to overcome the perceived barriers. The framework is clear and is prepared in a manner that makes it discernible at a glance by small-scale contractors. Further, the framework guides small-scale contractors to being vigilant about risks that may overlap in the course of the project cycle. Risks are inherent and unavoidable in the construction industry and small-scale contractors must learn to work with these risks that are spread throughout the project life-cycle. In conclusion, it can be recommended that small-scale contractors should map the prevailing risks associated with their work even as they resort to the proposed framework for the identification and management of risk in small-scale construction industry.

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