# Relationship between procurement systems and payment methods in assuring financial safety in Sri Lankan building projects

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## ABSTRACT

The Construction industry is a place where the parties to a project frequently face various risks throughout the project life cycle. Financial risks are one of the aforementioned risks that have a significant impact on parties, and more studies should be conducted to investigate the possibility of minimizing these financial risks and assuring the financial safety of projects. Thus, this research aims at identifying the relationship between procurement systems and payment methods towards assuring the financial safety of construction projects. Researchers selected government funded building projects to limit the scope because such projects frequently deal with financial risks. Frequent financial risks in a Government Funded Building Projects (GFBP) were identified as material shortages, fluctuation of inflation rate, legislation changes. The study used a mixed method approach, and data was gathered through semi structured interviews and questionnaires. Data was analyzed using manual content analysis and basic statistics. Common procurement systems and payment methods available in a GFBP were identified through interviews. Accordingly traditional, design and build, management oriented and collaborative procurement systems were identified and lumpsum, measure and pay, Guaranteed Maximum Price (GMP) and cost reimbursement were identified as payment methods. Furthermore, findings revealed that there are six common combinations between procurement systems and payment methods in GFBP. The identified combinations were further tested for their ability to minimize financial risks of GFBP and it was revealed that the combination consisting of Lumpsum with Design and Build was the best combination to assure financial safety in GFBP. Other combinations are traditional with measure and pay, design and build with lumpsum, design and build with GMP, management oriented with lumpsum, management oriented with measure and pay. Ultimately, a framework has been developed by harmonizing all the research findings in which parties can select the most viable combination to assure the financial safety of their project.

**KEYWORDS:** *Financial safety, Government funded building projects, Procurement systems*

## 1 INTRODUCTION

The construction industry is a very complex and unpredictable industry. According to the nature of the construction industry, procurement plays an important role in balancing the expenses of a construction project. Procurement means the process of capturing the goods or services needed to run a business or complete a project successfully (Leadership, 2019). Basically, there are four number of procurement systems. The traditional system, design and build system, management-oriented system and the collaborative system are those systems (Richards, 2006). Proper selection of the procurement system as well as the payment method also affect the success of the project. Payment is described as the

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exchange of money, goods, or services in proportions agreed upon by all parties (Kenton, 2021). Accordingly, there are a few payment methods used in the construction industry namely lump sum, measure and pay, cost reimbursement, and Guaranteed Maximum Price are examples of that (Rodriguez, 2019). Proper payment method selection helps to reduce the cash flow problems in the industry and in absence of such will create a financial risk to the parties. A financial risk is the probability of losing money on an investment or business venture (Hayes, 2021). Furthermore, financial risks are type of threats that could result in monetary losses for those involved (Hayes, 2021). If a project can move forward with less financial risks, it can be identified as a project is with good financial safety.

The government funded building projects in Sri Lanka are frequently experiencing financial risks (Scalisi, 2021). Thus, there is a need to find a mechanism to establish a financial safety net for parties in those projects. Hence, the authors established the research question as, whether a properly allied procurement system and payment method enhance the financial safety of government-funded building projects in Sri Lanka.

Research aim of this study was to identify the relationship between procurement systems and payment methods in assuring financial safety in Sri Lankan government-funded building projects. Research objectives were set as to identify the financial risks in Sri Lankan government-funded building projects, to identify the available procurement systems and payment methods in Sri Lankan government-funded building projects, to identify the most appropriate procurement system and payment method which minimize the financial risks in Sri Lankan government-funded building projects and to propose a framework for identifying the relationship between procurement systems and payment methods in assuring financial safety in government-funded building projects in Sri Lanka.

## 2 LITERATURE REVIEW

### 2.1 Financial risks faced by the main parties in a construction project

The construction projects are having different kinds of financial risks and Kolhatkar (2013) identified a few types of financial risks such as, bankruptcy of a project partner, fluctuation of interest rates, fluctuations in the inflation rate, fluctuation of the exchange rate, insurance risk, liquidity risk, variations in material prices, and material shortages. Bankruptcy is the legal status of a company or individual that is unable to repay its debts to creditors (Kolhatkar, 2013). The cost of borrowing money is expressed as an interest rate (Kolhatkar, 2013). Inflation is the gradual loss of a currency's buying value over time (Fernando, 2021). The definition of the exchange rate is, the value of one country's currency in relation to the currency of another country (A. Chen, 2020). If the contractor party or employer party fails to pay the insurance, it becomes a risk for the opposite party (Barone, 2021). As simply, cash in hand means a liquidity risk. The difference between the standard price and the real price for the actual quantity of materials used in manufacturing is known as material price variation (Barone, 2021). In economic terms, a shortage occurs when the amount demanded exceeds the quantity available at the market price (J. Chen, 2021). The payment works in the construction projects is unusual, and it puts a lot of financial risk on the shoulders of construction companies (Budde, 2016).

### 2.2 Payment methods in construction projects

Payment is defined as the exchange of money, products, or services for goods and services in proportions that have been agreed upon by all parties concerned (Kenton, 2021). There are a few payment methods used in the construction industry. Those are lumpsum, measure and pay, cost reimbursement and guaranteed maximum price. The most basic sort of construction payment is known as lump sum and contracts using these methods are known as "lumpsum fixed price contracts." The lumpsum method provides a single fixed price for every work completed (Finity, 2021). Remeasurement contracts are another type of contracts under payment methods. In remeasurement contracts it basically does the work, measures the work done, and makes the payments. It's useful when the design can be specified in acceptable detail but the amount cannot (Jeyakumar, 2016). A GMP is a cross between a cost-reimbursable and a fixed lumpsum. Contractors are reimbursed for costs incurred when they are incurred, which helps with cash flow (Herbert Smith Freehills, 2015). In cost reimbursement, it allows a contractor to get the personnel and materials needed to complete a project without having to fit those

resources into a predetermined price range (Landau, 2021). The payment method selection is linked with the procurement system selection. To ensure an effective construction process, it is essential to select the appropriate payment method in line with the appropriate procurement system.

### 2.3 Procurement methods in construction projects

Procurement means the process of acquiring the goods, resources, or services needed to run a business or finish a project successfully (Leadership, 2019). When choosing a procurement system, time, cost, and quality parameters should be considered, and the most appropriate procurement system that is safe for contractual parties should be chosen (Rashid et al., 2006). There are four types of procurement systems (Davis et al., 2006). Those are, traditional system, design and build system, management-oriented system and collaborative system. The most prevalent procurement system utilized in the building sector is traditional procurement. Design Bid Build is another name for it (Davis, 2008). This procurement system is mostly used in projects that do not have any special features in their design, like school buildings and hospital buildings etc. Here, the design and construction work are done separately, and the contractor is responsible for only the construction work (Gowrinath, 2016). Design and build system is one of the procurement approaches that is rapidly gaining popularity in order to meet the needs of today's construction employers who want to have a built facility (Gambo & Gomez, 2015). In here, the design and construction stages are overlapped. It has four variants as turnkey, novated design and build, package deal and develop and construct (Luenendonk, 2014). The management-oriented system divided in two types. Those are, management contracting and contract management. Collaborative procurement is a system allowing more than one client, consultant, contractor, or supplier to work together to procure work, services, or goods, share expertise, increase efficiency, and create value for money savings in the performance of projects or service objectives (Burnand, 2009).

### 2.4 Procurement systems and payment methods in Sri Lankan construction industry

All construction projects were procured via the traditional system in the early 1900s, and it still is with some variations today. The Sri Lankan construction industry has been using "measure and pay" under traditional system domains since the 1970s (Ariyachandra, 2018). That relationship contributes to the success of construction projects. Also, this traditional with measure and pay combination stand with high popularity in Sri Lanka. The design and build procurement system is identified as the second most popular system in the Sri Lanka and the lumpsum payment method is better to use with that (Ariyachandra, 2018). That relationship helps to avoid the unfair excessive profits earnings for all parties. Those are the most popular procurement method and payment method relationships in the construction industry. So, the correct selections help to achieve a successful construction project while avoiding financial risks.

### 2.5 Assuring financial safety in Government funded building projects in Sri Lanka

Sri Lankan construction industry has strong linkages with other sectors of the economy like urban development, public and private housing, land development, water supply and sewerage, telecommunications, etc. are a few examples of those sectors (Rameezdeen & Ramachandra, 2008). Sri Lankan government was involved in a number of residential, commercial, and mixed-use development projects during the past few years (Nandasena et al., 2021). Most of these projects were affected due to the instability of the country’s economy and the major parties involved for the project suffered financially (Gurtner, 2010).

Thus, it is paramount important to investigate strategies to minimize this financial risk in GFBP for the successful completion of the project. As the procurement system and the payment method of a project plays a vital role in a project success it is worth to examine whether there is any impact for assuring financial safety of the GFBP through a proper selection of procurement systems and payment methods.

## 3 RESEARCH METHODOLOGY

This research is basically about the relationship between procurement systems and payments in assuring financial safety in Sri Lankan government-funded building projects.

A comprehensive literature review was conducted to identify the financial risks, basic procurement systems and payment methods practicing in the construction industry and in order to identify the applicability of such methods in Sri Lankan context, expert's opinions were required. Since the authors intended to identify the most suitable procurement system and payment method combination to minimize the financial risks in GFBP in Sri Lanka the opinion of industry practitioners was collected. Thus, this research followed a mixed method approach.

Qualitative data was collected through semi-structured interviews. Basically, 10 semi-structured interviews were conducted. The semi-structured interviews were conducted with only chartered quantity surveyors and chartered engineers because, they have good knowledge of procurement systems,payment methods, financial risks, etc. and some of them have lots of experience in Sri Lankan government-funded building projects. Table 1 shows the profile of the interviewees.

Table 1. Profile of the interviewees

| Interviewee ID | Profession | Experience in the construction industry |
|---|---|---|
| **EI 1** | Charted Quantity Surveyor | 6 Years |
| **EI 2** | Charted Quantity Surveyor | 5 Years |
| **EI 3** | Charted Quantity Surveyor | 7 Years |
| **EI 4** | Charted Civil Engineer | 35 Years |
| **EI 5** | Charted Quantity Surveyor | 20 Years |
| **EI 6** | Charted Quantity Surveyor | 35 Years |
| **EI 7** | Charted Quantity Surveyor | 10 Years |
| **EI 8** | Charted Quantity Surveyor | 15 Years |
| **EI 9** | Charted Quantity Surveyor | 5 Years |
| **EI 10** | Charted Quantity Surveyor | 8 Years |

Quantitative data was gathered through a questionnaire survey. The questions were prepared by using the financial risks, procurement system and payment method combinations identified during the expert interviews. Thirty (30) responses were received and the answers were given based on a three-point Likert scale which offers highly suitable, averagely suitable and less suitable options for answering questions. Basically, undergraduates, quantity surveyors and engineers were selected as the sample and the highest priority was given to quantity surveyor's responses. Quantity surveyors are the people who are mostly involved in the procurement and payment processes, and they are highly knowledgeable in those areas. Therefore, the authors gave the priority to the quantity surveyors' responses.

As this is a **mixed method** research project, both qualitative and quantitative were analyzed. Data analysis and discussion was done by following both deductive and inductive approaches.

## 4 DATA ANALYSIS AND DISCUSSION

Eight (8) common financial risk factors were already identified through the literature review. By conducting expert interviews, it was determined which risk factors are applicable for the Sri Lankan government-funded building projects. In addition, three new financial risks were highlighted by the interviewees and with those three factors, completely ten factors were listed out through the expert interview's findings. Accordingly, fluctuation of inflation rate, fluctuation of exchange rate, variations in material prices, material shortages, legislation changes, payment delays, importation restrictions, liquidity risk, fluctuation of interest rate and absence of proper insurances selected as financial risk factors which can be there in the Sri Lankan government funded building projects.

Four procurement systems and four payment methods were already identified through the literature review. By conducting expert interviews, it was determined which procurement systems and payment methods are available in the Sri Lankan government-funded building projects. The answers of interviewees are shown in the figure 1 and figure 2, respectively.

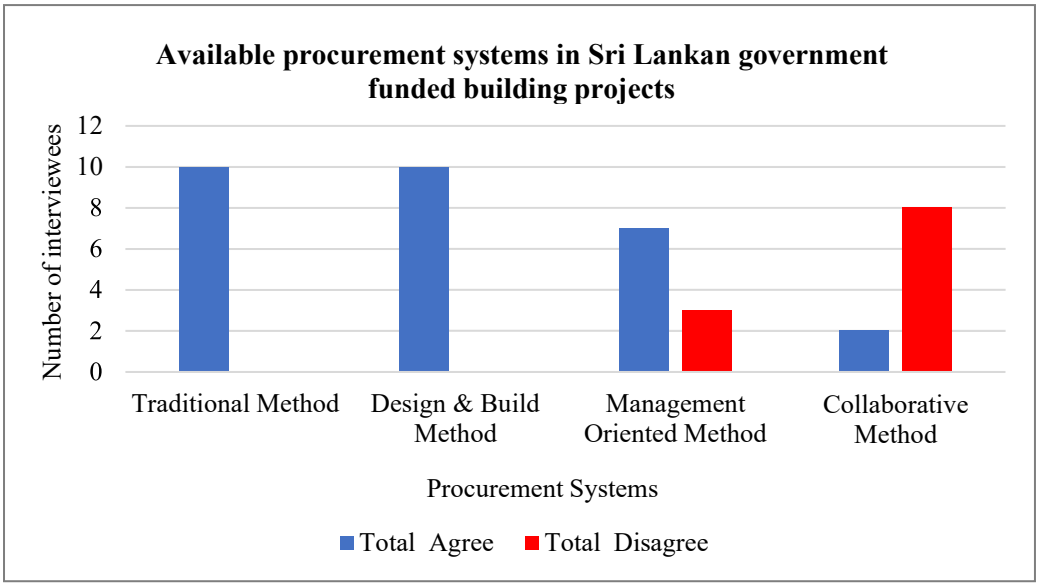



Figure 1. Responses of the available procurement systems in Sri Lankan GFBP

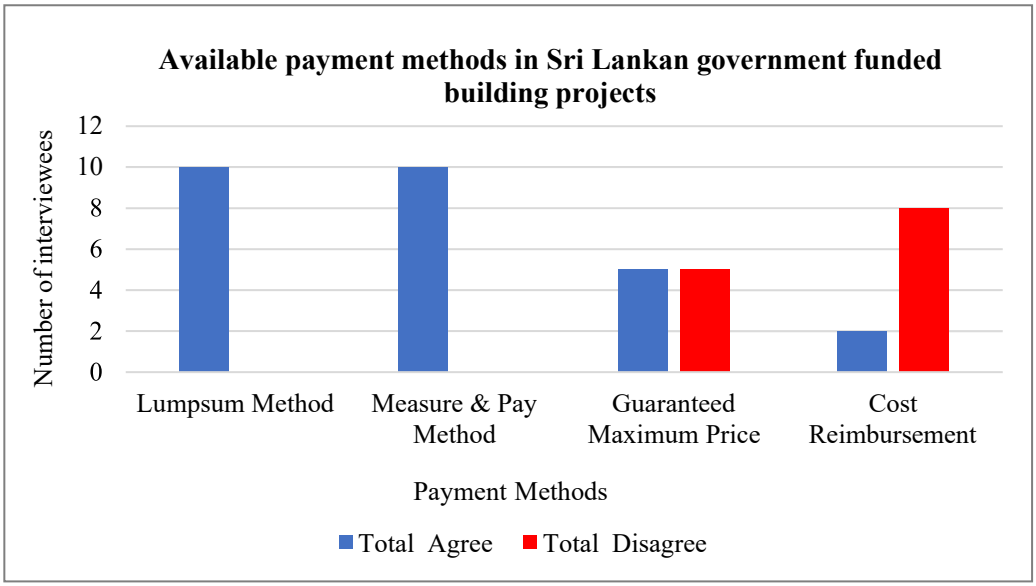



Figure 2. Responses of the available payment methods in Sri Lankan GFBP

As per opinions of the participants of the expert interviews, there are sixteen payment method and procurement system combinations which can be observed in the Sri Lankan government funded building projects. The combinations which were identified by more than 50% of the participants were considered as the most viable combinations, and those were taken to further analysis to check the most suitable combination to minimize financial risks in Sri Lankan government-funded building projects. Accordingly, design and build with lumpsum (100%), traditional with measure and pay (100%), traditional with lumpsum (60%), management oriented with lumpsum (70%), design and buildwith GMP (60%) and management oriented with measure and pay (80%) were selected for the further analysis.

The third objective of the research was to identify the most appropriate procurement system and payment method combination which minimizes the financial risks in Sri Lankan government-funded building projects. The said objective was achieved through the questionnaire findings. The questionnaire survey sample size was fifty (50) and there were thirty (30) responses received from the respondents. According to the respondents in questionnaire survey, the majority of the respondents are quantity surveyors. There are 15 respondents who have more than fifteen years of experience and as a percentage it is 50%. Only thirteen respondents have experience in the government-funded building projects.

Analysis of the questionnaire data were caried out using the **"mean values"** of the responses.

Steps of the analysis

**1st step**

The "mean" of all possible procurement system and payment method combinations was found by following the explanation given in the table 2.

Table 2. Sentiment level and numerical level

| Sentiment Level | Numerical Values |
|---|---|
| Less Suitable | 1 |
| Averagely Suitable | 2 |
| Highly Suitable | 3 |

Mean calculations were done according to the equation given in figure 3. It presents the nomenclature of all the variables used for calculations (A, B, C, D).

$$\text{Mean} = \frac{(A \times 1) + (B \times 2) + (C \times 3)}{D}$$

In this equation,
A = Number of responses for less suitable
B = Number of responses for averagely suitable
C = Number of responses for highly suitable
D = Total responses

Figure 3. Sample calculation for the mean

**2nd step**

Got the collection of "means" separately, for each of the combination against minimizing all ten (10) risk factors. Afterwards, the sum of the "means" for each of the six combinations in minimizing financial risks was obtained.

**3rd step**

In order to identify the most viable combination to minimize financial risks, individual means calculated as in the second step were added and divided by ten. This gives the "average mean value" of the particular combinations separately.

**4th step**

Afterwards, those "average mean values" were organized in descending order. Accordingly, the most suitable combination to minimize the financial risks in Sri Lankan government-funded building projects was identified.

The table 3 presents the mean values as according to the 1st step and calculated sum of those mean values as according to the 2nd step.

Table 3. Total of the "mean values" for six combinations

| No | Financial Risk | Mean of the combinations | | | | | |
|---|---|---|---|---|---|---|---|
| | | C1 | C2 | C3 | C4 | C5 | C6 |
| 01 | Fluctuation of Inflation Rate | 2.07 | 2.17 | 2.23 | 1.77 | 1.83 | 1.73 |
| 02 | Fluctuation of Exchange Rate | 2.03 | 2.17 | 2.30 | 1.77 | 1.90 | 1.77 |
| 03 | Variation in Material Prices | 2.13 | 2.30 | 2.23 | 1.83 | 1.87 | 1.70 |
| 04 | Material Shortages | 1.90 | 2.13 | 2.33 | 1.87 | 1.77 | 1.77 |
| 05 | Legislation Changes | 1.93 | 2.10 | 2.10 | 1.80 | 1.87 | 1.70 |
| 06 | Payment Delays | 2.00 | 2.23 | 2.37 | 1.70 | 1.80 | 1.80 |
| 07 | Importation Restrictions | 2.10 | 2.43 | 2.30 | 1.90 | 1.97 | 1.80 |
| 08 | Liquidity Risk | 2.20 | 2.40 | 2.33 | 1.83 | 2.10 | 1.90 |
| 09 | Fluctuation of Interest Rate | 2.10 | 2.23 | 2.33 | 1.87 | 1.97 | 1.90 |
| 10 | Absences of Proper Insurances | 1.97 | 2.13 | 2.27 | 1.90 | 1.83 | 1.67 |
| **Total** | | **20.43** | **22.29** | **22.79** | **18.24** | **18.91** | **17.74** |

The nomenclature of the combinations from the C1 to C6 is as below.

C1 – Traditional with lumpsum
C2 – Traditional with measure and pay
C3 – Design and build with lumpsum
C4 – Design and build with GMP
C5 – Management oriented with lumpsum
C6 – Management oriented with measure and pay

There are ten financial risk factors. Therefore, in order to calculate the 'average mean value', sum of the mean values in table 3 were divided by ten (As per the 3rd step). After that those values are set in descending order (According to the 4th step) as shows in the table 4.

Table 4. Descending order for "average mean values" in six combinations

| Combination No | Combination Name | Average Mean Value |
|---|---|---|
| **C 3** | Design and Build with Lumpsum | 2.28 |
| **C 2** | Traditional with Measure and Pay | 2.23 |
| **C 1** | Traditional with Lumpsum | 2.04 |
| **C 5** | Management Oriented with Lumpsum | 1.89 |
| **C 4** | Design and Build with GMP | 1.82 |
| **C 6** | Management Oriented with Measure and Pay | 1.77 |

According to the table 4, the highest "average mean value" is for the C3 combination. It means **the Design and Build Procurement system with Lumpsum Payment Method combination is the most suitable for minimizing majority of the financial risks in Sri Lankan government funded-building projects.**

As the final outcome of this research, a framework was developed by harmonizing all the findings. It shows the relationships between procurement systems and payment methods in assuring financial safety in government-funded building projects. It can be easily understood by following steps.

First of all, need to identify the color codes which used in the content lines here. This framework is based on the 'mean values' of the procurement system with payment method combinations. Table 5 presented the 'mean values' and color codes.

Table 5. Mean values of the combinations with color code

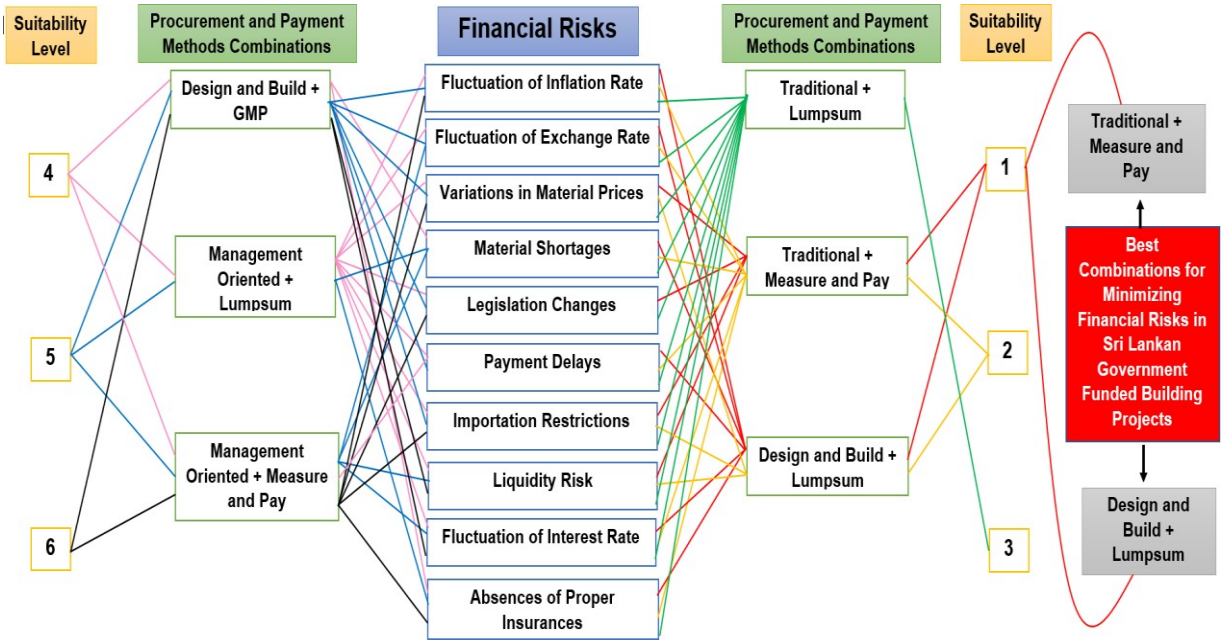
| No | Financial Risk | Mean Values of the combinations | | | | | |
|---|---|---|---|---|---|---|---|
| | | Traditional + Lumpsum | Traditional + Measure & Pay | Design & Build + Lumpsum | Design & Build + GMP | Management Oriented + Lumpsum | Management Oriented + Measure & Pay |
| 01 | Fluctuation of Inflation Rate | 2.07 | 2.17 | 2.23 | 1.77 | 1.83 | 1.73 |
| 02 | Fluctuation of Exchange Rate | 2.03 | 2.17 | 2.30 | 1.77 | 1.90 | 1.77 |
| 03 | Variation in Material Prices | 2.13 | 2.30 | 2.23 | 1.83 | 1.87 | 1.70 |
| 04 | Material Shortages | 1.90 | 2.13 | 2.33 | 1.87 | 1.77 | 1.77 |
| 05 | Legislation Changes | 1.93 | 2.10 | 2.10 | 1.80 | 1.87 | 1.70 |
| 06 | Payment Delays | 2.00 | 2.23 | 2.37 | 1.70 | 1.80 | 1.80 |
| 07 | Importation Restrictions | 2.10 | 2.43 | 2.30 | 1.90 | 1.97 | 1.80 |
| 08 | Liquidity Risk | 2.20 | 2.40 | 2.33 | 1.83 | 2.10 | 1.90 |
| 09 | Fluctuation of Interest Rate | 2.10 | 2.23 | 2.33 | 1.87 | 1.97 | 1.90 |
| 10 | Absences of Proper Insurances | 1.97 | 2.13 | 2.27 | 1.90 | 1.83 | 1.67 |

Here, the color code is determined by the 'mean value' of the combinations associated with each financial risk.

| | | | |
|---|---|---|---|
| | Suitability level 1 | – | Row wise, the highest 'mean values' are presented in Red |
| | Suitability level 2 | – | Row wise, secondly highest 'mean values' are presented in Orange |
| | Suitability level 3 | – | Row wise, thirdly highest 'mean values' are presented in Green |
| | Suitability level 4 | – | Row wise, fourthly highest 'mean values' are presented in Pink |
| | Suitability level 5 | – | Row wise, fifthly highest 'mean values' are presented in Blue |
| | Suitability level 6 | – | Row wise, sixthly highest 'mean values' are presented in Black |

The combination with the highest ‘mean value' for each financial risk, considered as the highest suitable combination to minimize that financial risk. Similarly, combination with the lowest ‘mean value' for each financial risk, considered as the lowest suitable combination to minimize that financial risk.

This framework should be observed from the middle to the sides. The lines, point from the financial risks to the procurement system + payment method combinations on either side (the colors of the lines are based on the table 4). There are suitability levels on both sides of the combinations. Suitability level 1,2,3 is in the right-hand side and suitability level 4,5,6 is in the left-hand side. Many lines points to the combinations and only one line from those (according to the color code), points to the matching 'suitability level'. It is then clear how appropriate it is to minimize that financial risk by using that combination. Both lines drawn from traditional with measure and pay combination and design and build with lumpsum combination, points to the suitability level 1 and the color code of the line is red. Hence, both combinations are the most suitable for minimize the risks of government funded building projects.




By using this framework, financial risks in government-funded building projects can be easily identified and procurement system with payment method combinations that can be used to minimize them also can be easily identified. Not only that, this framework explains the suitability level of each combination to minimize each financial risk. Therefore, this will be useful for Sri Lankan government-funded building projects to avoid the unnecessary failures in financial things.

## 5 CONCLUSION AND RECOMMENDATIONS

The aim of this research was to “Identify the relationship between procurement systems and payment methods in assuring financial safety in Sri Lankan government-funded building projects”. Accordingly, there were four objectives to be achieved.

The first objective is to identify the financial risks in Sri Lankan government funded building projects. Eight common financial risk factors in construction industry were identified through the literature review and through the expert interviews the same were checked against the applicability of such factors in Sri Lankan government-funded building projects. Accordingly, ten number of financial risk factors were confirmed through the interviews, and those are, fluctuation of inflation rate, fluctuation of exchange rate, variations in material prices, material shortages, legislation changes, payment delays, importation restrictions, liquidity risk, fluctuation of interest rate and absence of proper insurances.

The second objective is to identify the available procurement systems and payment methods in Sri Lankan government funded building projects. Similarly, available procurement systems and payment methods in construction industry were identified through the literature review and through theexpert interviews the same were checked against the applicability of such factors in Sri Lankan government-funded building projects. Accordingly, four number of procurement systems were confirmed through the interviews, and those are, traditional, design and build, management-oriented and collaborative system. Also, four payment methods were confirmed through the interviews, and those are, lumpsum, measure and pay, GMP and cost reimbursement method. But according to the interviewee's opinions, traditional, design and build procurement systems and the lumpsum, measure and pay payment methods were mostly available in the government-funded building projects. Furthermore, the procurement system with payment method combinations in the government funded building projects were identified through the interviews. Many of the interviewees said that these combinations could be happened. There are, design and build with lumpsum, traditional with measure and pay, traditional with lumpsum, management oriented with lumpsum, design and build with GMP, management oriented with measure and pay.

To identify the most appropriate procurement system and payment method which minimize the financial risks in Sri Lankan government funded building projects is the third objective. According to the results of the questionnaire survey, design and build with lumpsum combination was identified as the most suitable combination for minimizing financial risks in Sri Lankan government-funded building projects. In addition, it is advisable to use traditional with measure and pay combination, traditional with lumpsum combination, management oriented with lumpsum combination, design and build with GMP combination and management oriented with measure and pay combination respectively to minimize those risks.

According to the research findings, design and build with lumpsum combination can be recommended to use if there are financial risk such as, fluctuation of inflation rate, fluctuation of exchange rate, material shortages, payment delays, fluctuation of interest rate and absence of proper insurances. As well as, traditional with measure and pay combination can be recommended to use if there are financial risks such as, variations in material prices and material shortages. To minimize the financial risk of legislation changes in government-funded building projects, can be recommended both design and build with lumpsum combination and traditional with measure and pay combination as the most appropriate combinations. Accordingly, design and build with lumpsum combination can be recommended to use in Sri Lankan government funded building projects to minimizes financial risks.

As well as, secondly can be recommended, traditional with measure and pay combination to those projects.

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