PROCUREMENT SYSTEM SELECTION MODEL FOR THE SRI LANKAN CONSTRUCTION INDUSTRY

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ABSTRACT

Construction procurement system involves processes of acquiring services and products for the project activities starting from investigation up to the completion. With the development of new concepts and technologies, construction procurement arrangements have also advanced. Erroneous selection of a procurement system usually leads project to failure. Although, several procurement selection tools have been developed to minimize the adverse effect of overwhelmed wrong selections, those tools are not widely used in Sri Lanka (SL). Hence, it is vital to propose a new Procurement System Selection Model (PSSM) which can overcome barriers of existing PSSM.

A qualitative approach was used to identify prevailing practices and barriers to practice existing selection methods. Decision charts were developed by assigning average utility values for functional grouping, payment method and pricing mechanism.

Accordingly, the preliminary procurement system selection framework was arranged which includes seven steps namely; appoint an independent advisor, identification of project brief, identification and prioritizing factors affecting selection of procurement selection, choose functional grouping and payment modality, presentation of options found in step four in ascending order, selection of procurement strategy by the client and selection of parties involved in the project. Ultimately, proposed PSSM in this study merge the existing selection procedure in SL in a manner that leads selection into its best position. The study further recommends timely modernization of decision charts with Average Utility Value (AUV) and procurement systems, since suitability of each procurement system to selection criteria may change with development of construction industry.

Keywords: *Procurement System; Selection Criteria; Sri Lanka (SL).*

1. INTRODUCTION

Construction industry acquires a reputable designation in economic growth worldwide, which can set up the entire economic progression into the uppermost to lowermost in an uncertain manner. Hence, an advancement of the construction process comprises the potential for large cost saving, but the industry is still conservative and hesitates to accept strategies that are more efficient. With the availability of number of different procurement systems one of foremost daunting task which client and client advisors faces is selecting the most appropriate procurement system among the available procurement options. Even though procurement selection methods were developed, the practice of procurement selection is carried out in rather unstructured and ad hoc manner. Similarly, in Sri Lankan construction context there is no systematic realistic decision procedure used, to select the most appropriate procurement system for a particular project. Therefore, this research intends to address the problem of the reasons for the hesitance to use systematic selection method and thereinafter develop a comprehensive PSSM cooperative with Sri Lankan construction industry.

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2. PROCUREMENT SYSTEMS

The construction procurement; determined as the major element to achieve overall project strategic goals and the project success; structure that represents the distribution of responsibilities and authorities within participants involve in construction process (Ratnasabapathy and Rameezdeen, 2006). It addresses changes in economic, political, financial, technological and legal factors in efficient and effective manner which directly influence to the construction output, and loyal leadership; customer focus strategies; project team integration and focus to the quality of the industry; allure to use multifarious alternative construction procurement systems by the time (Rameezdeen and De Silva, 2002).

2.1. SUB-SYSTEMS OF PROCUREMENT ARRANGEMENT

Researches have divided procurement systems in several ways, as delivery system and contract system (New South Wales Construction Policy Steering Committee [NSW.CPSC], 2000) and further categorized as scope, organization, contract and award. Among those Kumaraswamy and Dissanayaka (1998) suggest more logical categorization of construction procurement system as shown Table 1.

Table 1: Sub Categories of Procurement Systems

Sub system	Description
Work packaging	The way slices work in to different packages vertically or horizontally, since the magnitude or the differentiations in geography, functional or disciplinary divisions (Kumaraswamy and Dissanayaka, 1997).
Functional grouping	The way of grouping functions of the project; design, construction, and management functions where responsibilities and authorities of each party is defined. E.g.: Separated, integrated, management oriented, PPP
Payment modalities	Valuation methods (fixed cost to cost reimbursement), currency, and the timing of the payments particular to the project
Form of contract	Conditions of contract varies as general conditions, special conditions which related to dispute resolution, special risks and standardize conditions
Selection methodology	Way of selecting consultant, contractor, Project Managers and other parties using negotiation, open tendering or envelop method

2.2. PROCUREMENT TRENDS IN SL

Due to the excessive demand for building and infrastructure projects the use of traditional procurement system can no longer meet clients' needs in an effective manner. In early 1900s, all the construction projects were procured under traditional systems and it continues until today with some modifications to improve cost, schedule and adversarial relationships through contractor centred approaches such as design and build in the private sector (Dorsey, 2004). As Dowd (1996) stated, construction management method began in 1960s and further developed in 1970s due to the economic recession. As well, consultative design and build also developed and project management emerged in 1980s' (Dorsey, 2004). Then in late 1990s and early 2000s management oriented approaches and collaborative working arrangements became more popular (McDermott and Khalfan, 2006). However, "Measure and Pay", under separated system domains the Sri Lankan construction industry from 1970s continuously, while usage of alternative procurement methods are neglected compared to other developing countries; So it means that, the Sri Lankan construction industry has not developed quite the same way as other developing countries (Ratnasabapathy and Rameezdeen, 2006).

Previous researches that have been carried out to identify different trends in construction procurement systems in SL by Rameezdeen and De Silva (2002), Ratnasabapathy and Rameezdeen (2006) and Jayasuriya (2010) presents the usage rates of procurement methods since 1970s. Table 2 presents trends in procurement systems used in SL from 1997 to 2009.

Table 2: Procurement Trends in SL

Procurement System	% of use (average)						
	1977-81	1982-86	1987-91	1992-96	1997-00	2001-03	2004-09
Separated System	77	68	71	61	77	78	80
– *Measure and pay*	55	50	58	50	64	72	69
– *Lump sum*	12	10	8	7	10	5	10
– *Prime Cost*	10	8	5	4	3	1	1
Integrated Systems	22	31	28	35	21	22	19
Management Systems	1	1	1	1	1	0	0
Collaborative Systems	0	0	0	3	1	0	1

The Table clearly highlight the dominance of separated system in SL, while "measure and pay" payment method stand with high popularity. However integrated system is identified as the second most popular procurement system but it decreased from 22 percent to 19 percent from 2004-2009. Jayasuriya (2010) stated that there is clear drop in usage of prime cost in large building projects with the rare existence of management oriented and collaborative systems in building sub sector. According to Shiyamini *et al.* (2005) the government as the regulatory body of SL has ignored practice of alternative procurement methods that emerged to enhance value for money and became the reason for the popularity of the measure and pay.

3. PROCUREMENT SYSTEM SELECTION

3.1. PROCUREMENT SELECTION METHODS

Ratnasabapathy and Rameezdeen (2006) stated that accurate choice of most appropriate procurement strategy drives to the realization of project specific goals and sidestep difficulties. Certainly, dissatisfaction about project success is the primary cause of selecting unearthly procurement strategy. The client or the representative, with their experience of past successful projects can choose the appropriate procurement method for the certain project (Mortledge, Smith, and Kashiwagi, 2006). Instead, inexperienced clients have to seek advices from procurement specialists (Love *et al*., 1998). Hence, procurement system selection has become a complex and challenging task to client and the representative who seeks value for money. Since present expansion of different systems and clients with lack of knowledge about selection of most fitting system, has resulted in increased demand for systematic methods for selecting the most appropriate arrangement for the particular project. According to Love *et al.,* (2008) the approaches developed for procurement selection range from simple to highly complex. It is important that selection is undertaken sensibly, analytically and in well-organized manner by the clients' principle advisor (Love, 1996).

3.2. DRAWBACKS OF EXISTING SELECTION METHODS

Guidance towards the selection of most appropriate procurement system must be accessible and incorporate a means of prioritizing client project criteria relating these to the suitability of the various procurement systems, to be valuable to users (Masterman, 2002). However, a number of drawbacks were identified with some or all of models, though all the models associated with various recognized approaches such as operational, statistical or electronic etc.; some of identified common drawbacks of existing selections are listed as follows;

- Only few factors are considered in almost all models for the main criteria of procurement selection and in some models, only some of clients' requirements and project characteristics are considered (Ratnasabapathy and Rameezdeen, 2007).
- Limited number of variants of main procurement systems are included in existing models and ignored certain available procurement systems in the industry (Ratnasabapathy and Rameezdeen, 2007).
- Some of available methods are conditional which can only use by selected extent of clients, therefore not widely applicable
- Some of the models with the use of advance mathematical techniques, are not user friendly and bit time consuming

- Some of the models with the use of advance computer packages are not user friendly and highly cost to buy (Ratnasabapathy and Rameezdeen, 2007).
- Some of the models adopt to primitive approach, so limit the number of options to be considered
- The cost aspects of the selected procurement systems have not been incorporated (Ratnasabapathy and Rameezdeen, 2007)

4. CRITERIA CONSIDERED IN PROCUREMENT SYSTEM SELECTION

Manley (2008) stated employer as the ultimate governing decision maker even though the representatives or consultants can change the form of procurement system. Therefore, the selected procurement system bound to satisfy the client's needs and wants, effectively to give the value for client's money. In order to satisfy the client, all procurement system selection processes prioritize time, cost, and quality, which simply means that client expects high quality with lower cost and minimum time; yet balancing all basic needs is almost difficult, on the fact of one or both needs will suffer when trying to achieve one requirement (Bagnall, 1999). According to Ng *et al.*, (2000), client's requirements or key drivers of the project, subjective to the background of the project take place, which means procurement selection criteria influenced by the factors drives externally to the project. Procurement method must address the technical features of the project with needs of client and contractor since each project has own unique characteristics. Accordingly, project characteristics such as type, size, complexity etc., should be considered in procurement selection. As a conclusion client's requirements and project characteristics which habitually influenced by external factors need to be considered when selecting appropriate procurement system to the specific project. Hence, procurement system selection criteria can be divide in to two major categorizes as illustrated Figure 1.

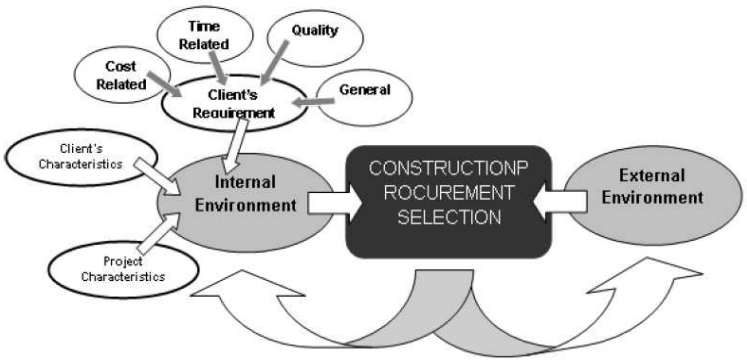

Figure 1: Categorization of Procurement System Selection Criteria

(Source: Rameezdeen and Jayasena, 2013)

4.1. CRITERIA CONSIDERED FUNCTIONAL ARRANGEMENT SELECTION

In Sri Lankan context, numerous researches were carried out to identify construction procurement selection. Gamage (2005) and Najeeb (2005) identified procurement selection criteria as clients' requirements, project characteristics and external environment factors; while Jayasuriya (2010) prioritized those factors according to SL's consideration. Further, Jayasena (2009) categorized criteria as private and public consideration. Following Table 3 describes the aforementioned identified factors affecting procurement selection.

Table 3: Factors Affecting Procurement Selection

Clients requirements	Upon basic three requirements (time, cost, and quality) risk management, price certainty, price competition, accountability, quality of work, familiarity, and flexibility for changes, responsibility and parties' involvement identified as clients' requirements.
Project characteristics	Factors like project cost and funding method, project complexity, project type, time constrains, degree of flexibility and disputes and arbitration are basically considered under project characteristics.

External environment factors	Projects cannot be isolated from the external environment and every project will receive impacts and information from the environment factors. Factors like market condition of the project, economic condition, technology, socio cultural suitability and regulatory environment identified as external environmental factors.

4.2. CRITERIA CONSIDERED FOR PAYMENT MODALITY SELECTION

The following Table 4 represents the criteria considered for payment modality selection.

Table 4: Criteria Considered for Payment Modality Selection

Time certainty	It is the ability to complete the project within the time agreed at the beginning of the time (Sherif and Kaka, 2003).
Price certainty	Establishing realistic cost estimate is vital in construction project, degree of faith of established price affected on selection of payment method for the particular project.
Forms of contracts	Available form of contracts provides guide to how and when contractor gets money entitle to him (Sherif and Kaka, 2003).
Contractor cash flow	Timing if cash inflow or outflow is vital and there can be time lags between intended for cash flow and actual timing of cash flow (Sherif and Kaka, 2003).
Speed (during Design and Construction)	Speed is very important factor of a construction project according to the client's need of the completion date.
Dispute likelihood	According to the nature of the project degree of arising dispute varies. However selected pricing mechanism and payment method need not help to arise new disputes.
Risk allocation	Various procurement paths including payment modality give different relationships and patterns of responsibility to the participants (Potts, 1988).
Project size	Construction projects are referred to different sizes. Larger size projects involve with more time and cost overruns due to complexity (Gamage, 2005).
Project complexity	Gidado and Millar (1992) stated that technical complexity, overlapping of design and construction phase, unpredictability decrease the performance of the works.
Procurement arrangement	Procurement arrangement is the way of allocating design, construction and management function responsibilities and authorities among parties to the project (Kumaraswamy and Dissanayaka, 1998).
Flexibility (accommodate the design changes)	Chan *et al*. (2001), flexibility is explained as up to what extent contractor is able to do changes for the design. Some procurement strategies are better than others in handling the introduction of changes later in the project (Kelly *et al.*, 2002).
Duration of tendering process	Clients' time requirement decides on availability of time for tendering process. As an example re-measurement is used where all the designs are not completed with limited time.
Tendering methods	Tendering methods can be classified as open, negotiation, selective etc. (Kumaraswamy and Dissanayaka, 1998). Duration, cost and agreement between parties vary according to the tendering method.
Value for money	Achieving value for money is the foremost expectation of introducing new theories to the construction industry (Miller *et al*., 2009).
Project budget availability	Availability of the budget decides on the quality of the project and specifications (Ashworth, 2013). As well as limited budget drives to price competition.

4.3. DOMINANT FACTORS CONSIDERED IN PROCUREMENT SYSTEM SELECTION IN SL

According to Jayasuriya, (2010) "only limited number of procurement selection parameters have been considered for procurement selection" in SL; mainly nine factors were highlighted in that research as the critical factors that considered in SL construction context where other factors have not been considered to a great extent. Those factors are familiarity, price certainty, time availability and predictability, risk management, accountability, project cost and funding method, price competition, flexibility for changes, regulatory environment, and technology.

4.4. PROCUREMENT SELECTION PROCESS IN SL

The construction sector of SL has become one of major value addition to national GDP contributing 8.7% while recording an impressive growth of 14.4% in 2013 (Balachandran, 2014). By providing evidence to above, statement SL is having increase the number of industrial, commercial, official buildings and national scale mega projects. Anyhow, in most of cases clients are not satisfied with the manner in which their requirements are being met (Gunasiri, 1997). According to Ratnasabapathy and Rameezdeen (2007) construction procurement route is the key factor which leads project and employer to the expected success. So, it is essential to select procurement route carefully by considering internal and external factors to achieve economic benefits out of the project. In reality, do clients or their representatives actually use a structured model for procurement selection? According to Masterman (2002) the practice of procurement selection is rather unstructured and ad hoc. This observation is, of course, very true for a developing country like SL (Rameezdeen and De Silva, 2002).

5. RESEARCH METHODOLOGY

Qualitative survey approach was selected to observe Sri Lankan procurement experts opinions on reasons for the hesitance of procurement experts to adopt systematic procurement system selection method. Research technique for the study mainly consists of two processes as data collection and data analysis. Data collection for the study was conducted in two phases. First phase was to identify present procurement selection process and hesitance to adopt selection method in Sri Lanka was fulfilled through preliminary interviews. Three public sector procurement experts as well as three private sector procurement experts were selected and semi structured interviews were conducted. Procurement experts who attended for interviews by designation limited to the Quantity surveyors with more than 10 years' experience. Table 5 provides the respondents profile for the semi structured interviews carried out.

Table 5: Respondents' Profile for the Semi Structured Interviews

Interviewee	Carrier	Experience	Sector
Interviewee A	Senior Quantity Surveyor	14 years	Private
Interviewee B	Senior Quantity Surveyor	10 years	
Interviewee C	Chief Quantity Surveyor	18 years	
Interviewee D	Chief Quantity Surveyor	15 years	Public
Interviewee E	Chief Quantity Surveyor	20 years	
Interviewee F	Chief Quantity Surveyor	14 years	

Second phase to prepare Procurement Decision Chart (PDC) was accomplished through three rounds of questionnaire surveys to identify factors and attain utility values against procurement arrangements. Forty (40) professionals who involved with building construction procurement process were selected. The sample consist with Project managers, Construction managers and chief quantity surveyors who have more than five years' experience in private sector. Table 6 represents the demographic characteristics of survey sample. Snowball sampling method under non-probability sampling was used due to lack of personal contacts with procurement experts in the Sri Lankan construction industry.

Table 6: Demographic Characteristics of Survey Sample

Profession	Experience (X) in SL	Experience (X) out of SL	No. of recipients
Project Managers	X > 5 years	X > 15 years	2
	X > 5 years	X < 15 years	3
Construction Manager	X > 5 years	X > 15 years	2
	X > 10 years	X > 15 years	1
Chief Quantity Surveyor	X > 5 years	X > 5 years	7
	X > 10 years	X > 5 years	5
Project Quantity Surveyor	X > 5 years	X > 5 years	9
	X > 10 years	No X	11
		Total	**40**

Data produced from the preliminary interviews was the views and opinions of participants, which were text data but not numbers. Content analysis technique was used to analyse preliminary interviews and transcripts were produced in the way of conversation and analysed opinions of experts manually. Finally, the analysis was used to prepare preliminary procurement system selection framework.

Data produced from questionnaires was quantitative data at all three rounds. Hence, the analysis was done using Mean Weighted Rating (MW), Severity Index (SI), Coefficient of Variations (COV) and Concordance of Coefficient (W).

6. RESEARCH FINDINGS

6.1. PROCUREMENT SYSTEM SELECTION MODEL

Identify present procurement selection process and hesitance to adopt selection method in Sri Lanka

According to five out of six expert's experience, 80%-90% projects in SL are based on separated re-measurement method since industry is reluctant to adopt developed methods and government promotes traditional methods in order to protect transparency. Moreover, private sector experts highlighted that, past few years individual employers had selected design and build method with lump sum pricing as a trend without any advice from consultants and majority of those projects ultimately became failures. Therefore consultants also promote separated re-measurement method. Another argument was that clients' requirements are vague and client neither have knowledge nor familiar to interpret their requirements as appropriate to other procurement systems. Similarly, with the failures happened last few years by using other procurement methods, clients are anxious to occupy with other procurement methods. However, getting advice from a consultant was suggested by all the interviewees prior to using any kind procurement method. Present selection of procurement system happens generally based on personal criteria adopted by consultants based on their experience. The following steps are identified for the existing process;

- 1st step – meeting client and consultant, identify clients objectives
- 2nd step – selection of procurement system by the consultant

According to expertise opinion non-availability of understandable model, Existing models are not prepared for Sri Lankan context, Non availability or unawareness about standard documents for other procurement systems other than separated system or design and build systems, Existing models only consider about established method but not bespoke methods are most common reasons to not adopt to systematic procurement selection method. And also expertise expecting easiness of use, time saving, easily understandable process, transparency of system selection process from procurement system selection method when using it. With the opinions of expertise procurement system selection framework were produced. Ultimately PSSM illustrated in Figure 2 was produced using the framework.

In order to perform 4th step of the PSSM, the Procurement Decision Chart shown in Figure 3 was developed using Multi Attribute Utility Technique (MAUT), which is a methodology developed to help decision-makers assign utility values, taking into consideration the decision-makers' preference, to outcomes by evaluating these in terms of multiple attributes and combining these individual assignments to obtain overall utility measures (Meteo, 2012) as mentioned in following paragraph.

AUVs which represents relationship between identified criteria and various procurement methods, were obtained for functional groups, payment method and pricing mechanism as shown in Tables 7,8 and 9. AUV calculated using utility values which were assigned by the expertise in the questionnaire survey. Lower AUV represents lower suitability of particular procurement method referred to particular criteria while higher AUV represents higher suitability of particular procurement method referred to particular criteria. When selecting a procurement method in real life advisor can determine weightings from 1-10 against each criteria particular to specific project. After advisor assigned weightings against each criteria, weighting is multiplied by AUV under the each options. Then sum of results under every option is compared and ranked in descending order. Option, which gets first rank will be chosen as the most suitable option.

Table 7: AUVs for Procurement of Functional Groups

	Selection Criteria	Procurement Functional Grouping											W
		Separated		Integrated					Management Oriented				
		Seq.	Acc.	D&B	PD	TK	D&C	Nov	MC	CM	D&M	PM	
1	Financial risk	70.3	65.7	76.3	91.2	89.7	83.4	83.5	62.4	66.1	60.3	74.5	0.4623
2	Construction time	51.4	71.5	84.7	77.8	75.4	80.3	75.4	59.5	61.7	60.2	72.9	0.5087
3	The early start of project	49.4	56.7	89.4	98.2		80.5	73.9	67.4	66.0	71.4	77.4	0.4015
4	Price certainty	64.3	76.9	76.8	100.0	100.0	74.4	77.6	71.4	71.2	70.4	79.6	0.3276
5	Price competition	93.2	92.6	81.3	64.9	53.4	76.0	42.7	67.9	65.8	61.2	58.4	0.6461
6	Accountability	82.6	80.5	69.0	48.3	57.7	72.9	73.6	81.9	84.7	83.4	88.3	0.5100
7	Functionality	65.0	61.7	72.8	83.4	70.9	73.5	74.8	87.3	81.0	83.8	88.2	0.4289
8	Familiarity	96.8	96.8	82.8	70.1	45.6	44.8	61.0	38.9	46.2	40.5	56.7	0.7120
9	Client's flexibility	56.8	62.1	78.9			76.5	77.2	81.4	80.6	81.3	82.6	0.3791
10	Allocation of responsibilities												
	-Contractor only			100	100	100							1.0000
	-Consultant and Contractor	100	100				88.4	92.4					0.7516
	-Involvement of Construction Manager								100	100	100	100	1.0000
11	Project cost	63.6	66.6	84.2	85.3	79.4	70.1	73.1	67.9	69.4	68.7	69.3	0.3001
12	Degree of complexity	54.3	56.3	89.4	45.8	52.9	82.5	80.6	87.3	85.4	86.1	58.3	0.4386
13	Project type												
14	Time constraints	61.6	59.9	76.4	81.3	79.8	64.2	60.5	65.8	62.3	62.4	63.9	0.4592
15	Degree of flexibility	82.5	76.3	52.3	69.3	48.8	72.5	73.4	74.9	73.1	70.6	75.7	0.3847
16	Dispute and Arbitration	84.5	81.7	42.9	32.7	30.1	45.8	47.3	75.3	74.3	72.0	77.7	0.4945
17	Market condition for the project	78.6	83.7	81.2	60.2	72.9	64.9	65.8	56.7	59.0	62.1	65.9	0.3099
18	Technological feasibility	71.0	65.9	45.7	44.3	41.8	49.1	56.3	80.2	74.5	72.6	82.0	0.3618
19	Cultural differences	61.4	60.7	54.5	67.4	62.1	59.0	58.4	79.3	79.5	81.4	80.7	0.2019
20	Education of builders	66.9	69.4	85.8	86.2	88.1	85.4	82.3	71.6	72.3	75.2	74.1	0.4456
21	Regulatory feasibility	78.2	77.3	70.3	76.3	68.7	69.2	72.4	53.2	54.3	48.0	55.1	0.3534

Seq.-Sequential, Acc.-Accelerated, D&B-Design & Build, PD-Package Deal, TK-Turn Key, D&C-Develop & Construct, Nov-Novation, MC-Management Contracting, CM-Construction Management, D&M-Design & Manage, PM-Project Management

Table 8: AUVs for Procurement of Payment Method

	Selection Criteria	Procurement Payment Method						W
		With Advance Payment			Without Advance Payment			
		IP	MP	SP	IP	MP	SP	
1	Contractor cash flow	70.8	71.9	77.1	52.4	45.3	68.3	0.5608
2	Financial risk	82.0	69.1	62.7	69.3	63.2	60.4	0.4012
3	Tendering method							
4	Project duration	68.5	77.1	83.5	61.4	74.8	82.9	0.7725
5	Familiarity	87.0	85.6	54.2	81.9	73.9	45.1	0.7100
6	Project type							
7	Risk management	70.2	78.2	63.8	55.3	52.1	49.9	0.4148
8	Contract form							
9	Price certainty	60.9	56.7	73.6	75.9	61.0	60.8	0.4512
10	Speed (during D & C)	83.5	79.3	78.1	64.6	60.2	57.3	0.5385

IP-Interim Payment, MP-Milestone Payment, SP-Stage payment

Table 9: AUVs for Procurement of Pricing Mechanism

	Selection Criteria	Procurement Pricing Mechanism									W
		Price based		Cost based		Target price					
		R-M	LS	C + PF	C + FF	GMP	Alliance				
							Pure	Comp.	Hybrid	Prog.	
1	Familiarity	81.3	80.2	70.4	64.0	65.3	21.0	18.4	19.8	11.1	0.6791
2	Price certainty	71.6	76.9	61.2	66.6	73.1	77.4	79.1	76.0	81.3	0.3502
3	Risk management	56.7	77.8	59.9	69.5	62.4	80.3	82.1	79.6	80.2	0.5163
4	Flexibility for changes	85.5	66.0	80.8	81.6	63.5	54.8	54.1	51.0	52.3	0.5623
5	Project cost and funding method	72.4	78.7	63.5	65.8	77.6	74.1	80.3	78.1	61.0	0.4821
6	Project complexity	63.4	80.5	59.1	51.4	55.2	88.6	87.1	87.4	81.8	0.5900
7	Functional grouping	82.3	80.6	77.1	70.5	55.4	43.7	40.9	55.2	34.3	0.6607
8	Disputes likelihood	85.1	61.7	71.5	73.0	62.3	55.3	59.1	79.4	46.7	0.4011
9	Tendering methods										
10	Economic Condition	55.1	82.3	63.9	65.2	53.6	67.1	66.8	78.5	43.0	0.3727
11	Tendering time	61.9	86.8	54.2	55.9	64.2	74.5	52.0	76.9	75.0	0.4045
12	Client experience	60.8	80.9	77.3	65.4	60.9	52.0	55.2	67.7	45.3	0.5946
13	Value for money	50.4	77.4	32.4	38.3	79.8	81.0	54.6	65.1	82.5	0.4500

R-M-Re-Measurement, LS-Lump sum, C+PF-Cost plus percentage fee, C+FF-Cost plus fixed fee, GMP-Guaranteed maximum price, Comp-Competitive, Prog.- Programme

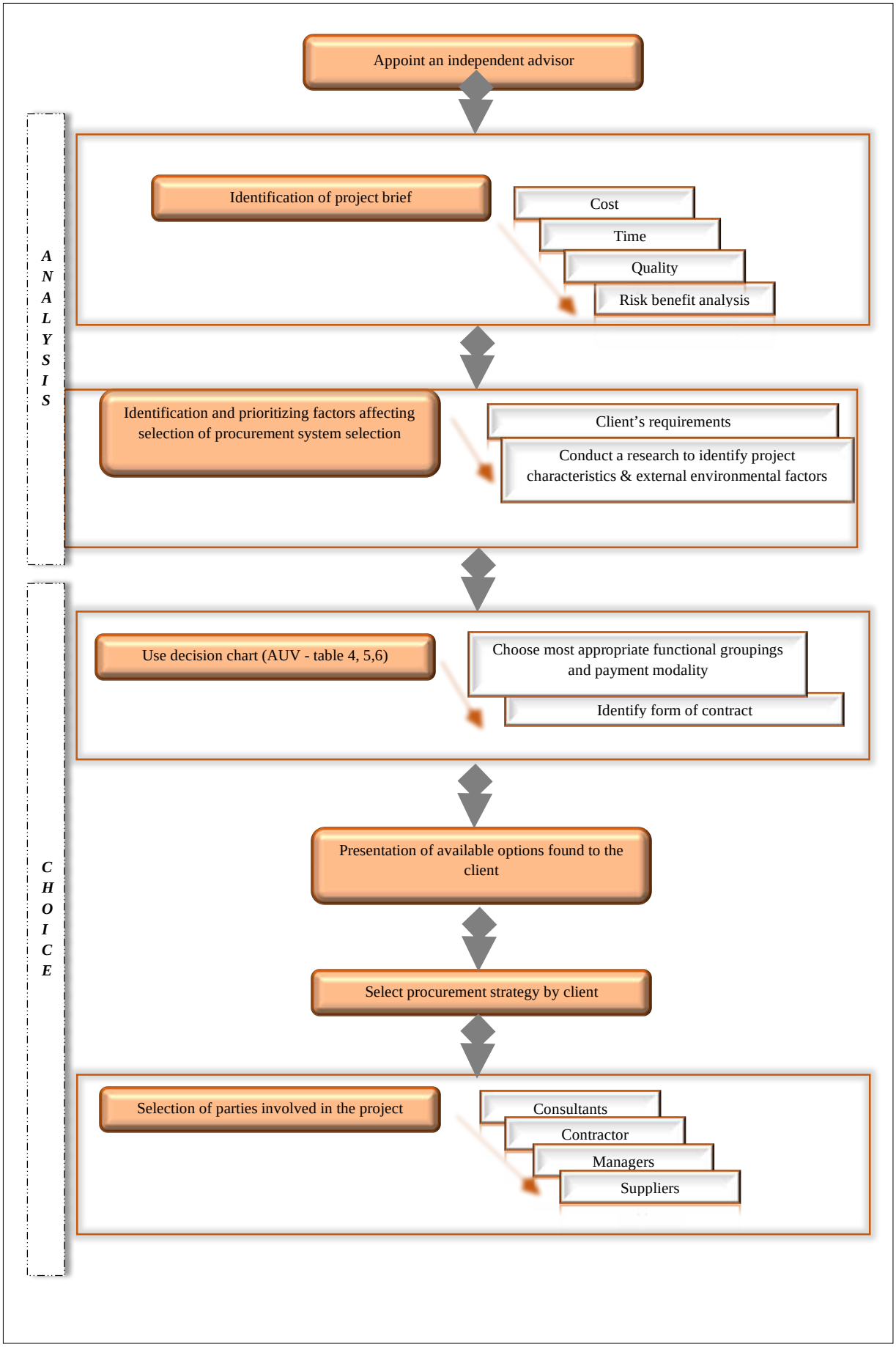

Figure 2: The Proposed PSSM

	Selection Criteria	Weight assigned by the advisor (0-10) Wi	Price based				Cost based		
			R-M AUV	AUV×Wi	LS AUV	AUV×Wi	C + PF AUV	AUV×Wi	C + FF
1	Familiarity	5	81.3	406.5	80.2	401	70.4	352	64
2	Price certainty	8	71.6	572.8	76.9	615.2	61.2	489.6	66.6
3	Risk management	10	56.7	567	77.8	778	59.9	599	69.5
4	Flexibility for changes	7	85.5	598.5	66	462	80.8	565.6	81.6
5	Project cost and funding method	4	72.4	289.6	78.7	314.8	63.5	254	65.8
6	Project complexity	8	63.4	507.2	80.5	644	59.1	472.8	51.4
7	Functional grouping	2	82.3	164.6	80.6	161.2	77.1	154.2	70.5
8	Disputes likelihood	8	85.1	680.8	61.7	493.6	71.5	572	73
9	Tendering methods			0		0		0	
10	Economic Condition	8	55.1	440.8	82.3	658.4	63.9	511.2	65.2
11	Tendering time	1	61.9	61.9	86.8	86.8	54.2	54.2	55.9
12	Client experience	0	60.8	0	80.9	0	77.3	0	65.4
13	Value for money	10	50.4	504	77.4	774	32.4	324	38.3
	Total (ΣAUV×Wi)			4793.7		5389		4348.6	
	Rank			2		1		3	

R-M-Re-Measurement, LS-Lump sum, C+PF-Cost plus percentage fee, C+FF-Cost plus fixed fee, GMP-Guaranteed maximum price, Comp-Co

Figure 3: Procurement Decision Chart

7. CONCLUSIONS

The research identified that procurement system selection process in SL is rather unstructured and ad hoc. It was verified in analysis through expert opinion survey and identified two steps as, meeting Client and consultant, identify clients' objectives and selection of procurement system by the consultant. The present selection process only considered time, cost and familiarity of procurement system. Furthermore, seven factors were identified as reasons for hesitance of Sri Lankan procurement experts to adopt systematic procurement system selection. Those are; not availability of understandable model, existing models are not prepared for Sri Lankan context, with the experience of experts they can select suitable procurement system within short time period, non-availability or non-awareness about standard documents for other procurement systems other than separated system or design and build systems, existing models only consider about established method but not bespoke methods, government promotes only separated re-measurement system, existing models supports people who has knowledge on procurement system selection but not the clients with lack of knowledge.

Contractor cash flow, financial risk, tendering method, project duration, familiarity, project type, risk management, contract form, price certainty, speed (during Design & Construction) were identified according to their significance level as factors affecting selection of payment method. Familiarity, price certainty, risk management, flexibility for changes, project cost and funding method, project complexity, functional grouping, disputes likelihood, tendering methods, economic Condition, tendering time, client experience, value for money were identified according to their significance level as factors affecting selection of pricing mechanism.

The proposed PSSM. It includes seven steps as, appoint an independent advisor, identification of project brief, identification and prioritizing factors affecting selection of procurement selection, choose functional grouping and payment modality, presentation of options found in step four in ascending order, selection of procurement strategy by the client, and finally selection of parties involved in the project.

In addition to seven steps, for the fourth step procedure of selecting functional grouping and payment modality using MAUT.

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