A Study of Transaction Cost within the Supply Chain Network in Malaysia Construction Projects

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***Abstract*— Construction industry of Malaysia is a complex and confronts with serious issues of cost overrun. Construction supply chain which involves multi-layered supply network carries lot of potential for conflict and additional costs involving additional transaction cost. To tackle this issue, the primary aim of this study is to identify component of waste in transaction cost within multi-layered supply chain network in Malaysian construction industry. The qualitative research approach is adopted to achieve the research objectives of this study. The data were collected through semi-structured interview from five (5) quantity surveyors working with a contractor firm situated within Klang Valley region. The implication of the finding implies that the identified data are crucial in eliminating waste in transaction cost.**

***Keywords*—** *Construction, supply chain network, transaction cost, wastage*

1. Introduction

Construction industry plays some significant role in generating revenue, increase the employment rate and serves as a key contributor to the gross domestic product (GDP) of Malaysia. According to the statistics provided by Department of Statistics Malaysia, the industry has been contributing to 11.2 % year-on-year to record RM33.8 billion in the second quarter of 2017. However, construction sector undoubtedly is a complex and dynamic project and suffers cost overrun. According to a study on 359 projects in Malaysia (308 public projects and 51 private projects), Malaysia confronts with serious issue of cost overrun in construction industry where only 46.75% of public projects and 37.25% of private projects were successfully accomplished within the predetermine budget [1]. On the other hand, construction industry in Malaysia suffers with cost overrun with an average of 2.08% from the original budget from 53.25% of public projects and 65.75% private projects [2].

Cost performance is one of the indicators of successfulness of construction project and generally construction industry in Malaysia suffers poor cost performance due to cost overrun [3]. In construction industry, it is essential to implement proper cost management of construction projects to make sure the construction cost does not suffer from cost overrun [4]. According to a research study made by Abdul Rahman [1], the major factors affecting cost overruns in large construction projects in Malaysia are the fluctuation of price of materials.

Generally, construction industry is involves with various networks of organisation and upstream and downstream linkages throughout the supply chain network which cover the cooperative interaction of intra-organisation and inter-organizational relationship [5]. This multi-layered supply network carries lot of potential for conflict and additional costs involving additional transaction cost at each interface or partnership [6-8]. Transaction costs can be defined as a final price or total price of a project which involves the whole costs correlated with business exchanges between firms including ‘ex ante transaction costs’ and ‘ex post transaction cost’ [8]. There are external factors that causes in the uncertainty of prices in transaction cost as it was being influence by two factors which are behavioural assumption (bounded rationality and opportunism) and due to procuring complexity. These uncertainties are the wastages which is also known as non-value adding activities that involves

direct or indirect costs but do not add any value to the product without the clients' knowledge [9],[10] which contribute to the increase in transaction cost and being identified as one of the factors that causes the fluctuation of price of materials [1] which eventually resulting in cost overrun of the project [2].

Therefore , the primary aim of the research is to eliminate waste in transaction cost within multi-layered supply chain network in Malaysian construction industry by investigating the issues related to the implementation of conventional cost management, identifying the uncertainties in transaction cost in construction supply chain and studying the relevance of available construction cost management in resolving construction waste. The scope of this research is to focus on inter-organizational relationship from the perspective of main contractor who is partnering with downstream (client) and with upstream (subcontractor). The respondents for this research is limited to quantity surveyors who are working with Grade 4 to Grade 7 contractors that involved with public and private projects in Klang Valley area that experience cost overrun in their projects and manage to overcome it.

2. Research methodology

This research is using qualitative research approach to understand the underlying problem and diagnose a situation through semi-structured interviews to five (5) quantity surveyors who are working with Grade 4 to Grade 7 contractors who are involved with public and private projects in Klang Valley area. Snowball sampling method was used to speed up the process of finding interviewees that have the adequate and relevant knowledge and experience in the studied area.

3. An Overview of Transaction Cost within the Construction Supply Chain Network

According to Fundrise [11], there are two types of construction expenses i.e., hard cost and soft cost. Transaction cost is one of the construction cost drivers under soft cost and it is defined as indirect cost that are related in the process of constructing a building. Soft cost involves non-physical expenses such as professional fees for the consultant team, contractual documentation cost and legal fees and comprises of transaction cost. The terms transaction cost as according to [12] can be defined as "economic counterpart of friction" which are the frictional cost of business interaction between suppliers and customer of the upstream and downstream of supply chain network to obtain raw or end product material and parts, and services [13].

Transaction cost in every supply chain network comprises of various cost such as cost on the expenditure on supplies, transport, labour involves in the activities, information costs, negotiation costs, and monitoring such as drafting contracts or preparing other contract documentation at every economic business operation that will affect the final price of materials [14],[20]. Transaction cost involves in all business which can be classified into three main classifications which are information costs, negotiation costs, and monitoring costs [14] Basically, it is important to strategically manage the transaction costs in order to minimize the final costs that acquired at each interface between a user and suppliers [13]. Pulling together from many literatures as shown in Table 1, this study has listed the components of transaction cost that is involved in inter-organisational relationship in the context of construction industry between upstream and downstream supply chain network as shown in Figure 1.

Table 1. Component of transaction cost within inter-organisational relationship in construction industry supply chain network.

Information cost	Negotiation Cost	Monitoring Cost
• Advertising Tender Notice (Kwon et al., 2011) • Searching For Supplier (Hobbs, 1996) • Searching for Subcontractor (Kwon et al., 2011) • Market Research (Hobbs, 1996)	• Contract Documentation Cost (Kwon et al., 2011)) • Bidding and Tendering Cost (Li et al., 2012) • Procuring Goods (Li et al., 2012) • Logistic Fees • Hiring Lawyers (Hobbs, 1996) • Claims Consultant (Li et al., 2012) • Auctioneer Or A Broker (Li et al., 2012)	• Late Payment by The Employer (Li et al., 2012) • Security Fees (Hobbs, 1996) (Kwon et al., 2011) • Storing Cost (Hobbs, 1996) • Maintenance Cost (Hobbs, 1996) (Kwon et al., 2011) • Dispute Resolution (Li et al., 2012) • Change Orders (Li et al., 2012)

4. An Introduction to construction industry supply chain network

Generally, supply chain involves all of the organization or individual in the making of product or services from both upstream and downstream, from the component suppliers, manufacturers, distributors and finally to the ultimate customers [15]. Supply chain encompasses all of the activities that involves all of the processing of a product such as the process of procuring, scheduling, ordering, inventory management, transporting, storage and all of the necessary processes to from raw material to completion of a high-quality product or service to the customer. According to [16], the basic of supply chain comprises of two integrated process which are the production planning and inventory control process and the distribution process. Construction supply chain comprises of three dimension which are the administration of activities and the processes, intra-organizational and lastly inter-organizational coordination. Activities and processes administration involves the process of managing raw material until the completion and logistic activities such as warehousing and order management [17]. Intra-organisation relationship is the cooperation and coordination between same department in the same company or between a department in different company such as marketing and financial department. On the other hand, inter-organisational relationship involves flow of product between the participant in the supply chain network which is between buyer-seller, supplier-manufacturer, main contractor-sub contract, or client-main contractor [18].

4.1. Inter-organisational supply chain

Inter-organisational supply chain can be defined as the two or more entities which consist of individuals or organizations entities who are directly involved in the upstream such as supplier and manufacturer and downstream such as customer which enter into business operation in the form of product, services and information from the suppliers to the ultimate customer [15]. In the context of construction industry, focal company such as the main contractor involves business transaction or vertical supply chain network with upstream entity involving client or project owner and the downstream which consist of specialist subcontractors, subcontractors and suppliers as shown in Figure 1. Figure 1 also shows that construction supply chain involves multi-layered supply network which creates a major additional transaction cost from the supplier of raw material to the ultimate customer. Accumulation of transaction cost from the procuring of goods from the supplier through multi-level network would causes in the increases of prices and the ultimate client would suffer the burden the total transaction which includes the additional transaction cost or wastages.

The complexity of construction supply chain network will create an additional transaction cost and carries lot of potential for conflict and additional costs involving unnecessary costs at each interface or partnership [10],[19],[20]. Additional transaction cost due to complexity of transaction can be equated with waste as it provides no value to the product but consume the waste of time and money. Hence, it is important for the contractor to implement proper cost management system in order to eliminate the additional cost or wastages that would affect the contractor's financial gains or profit and to maintain the construction project complete within the agreed budget such as supply chain costing.

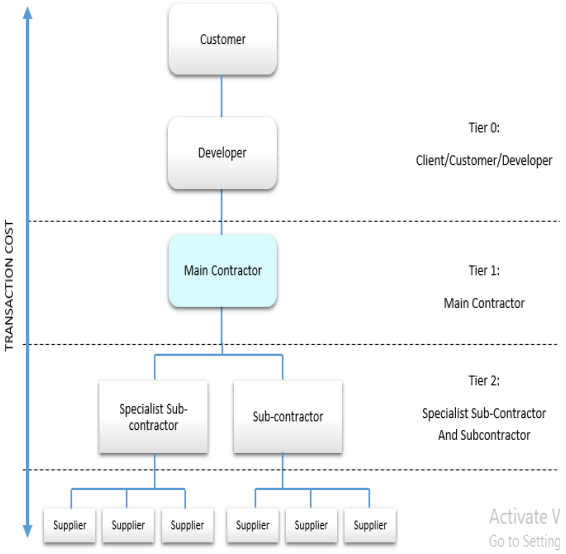

Figure 1. Construction supply chain network [8]

4.2. Factors affecting transaction cost

According to transaction cost economist, [12] have identified that there will be two factors that will results in waste in transaction cost which are 'Behavioural Assumption' which consist of recognition of human agents subjected to **bounded rationality** and **opportunism** and **'Procuring Complexity**' which would result in the fluctuation of transaction cost.

4.2.1.Behavioural assumption

Behavioural assumption which consist of opportunism and bounded rationality are being categories as waste in transaction cost as it is not only affect the effectiveness of the organizational but also highly influences the transaction cost (frictional cost) at the interface between supplier and focal company [12-14]. The following are the detail explanation .

4.2.1.1. Opportunism

According to transaction cost economist [12] opportunism can be defined as making provision for self-interest seeking with fraud. Opportunism can also be defined as self-interested person or group to exploit situations for their own advantages by handling business transaction through cheating, lying guided by considerations of with guile [13], [14]. Generally, opportunism is one of the human agents which operates the transaction with consideration of self-interested with secretive, deceptive and guileful by providing inaccurate or incomplete information, cheating and lying to generate extra profits from vulnerable partners. Opportunistic behavioural is unacceptable by transaction cost economics due to its strong influence on the organizational effectiveness and the frictional cost. The risk of opportunism present when there is problem with few alternatives of procuring goods. The potential for opportunism in construction has also being recognize by [15] which illustrate the opportunist prices by contractors as 'extra cost'. The incentives for opportunism due to underperformance of the completed project can be reduces through relationships between exchange partner by implementing detail documentation of the contracts. These detail documentations can be used as reference on future transaction to eliminate opportunism in transaction cost.

4.2.1.2. Bounded Rationality

According to transaction cost economist [12] bounded rationality is the limit of human factor and their capacity and capability to make rational decision and evaluate all decision, and to work under limited time which results in unpredictable inadequate contracts. Perfect rationality is the ability to receive information and communication without problem under condition of uncertainty. On the other hand, bounded rationality can be defined as ability to make rational decision under condition of uncertainty but capacity to evaluate all of the possible decision alternatives is physically limited. Transaction agent which experience bounded rationality will face limits in processing and receiving information, problem solving and decision making [12]. According to transaction cost economist, bounded rationality can be defined as "neurophysiological and language limits of individuals" which act rationally in making decision but are limited physically.

Bounded rationality is unacceptable by transaction cost economics due to its strong influence on the operational effectiveness and the frictional cost because of limited managerial time and control. Bounded rationality is the human factor which generally describe the capability and ability of organization that it is impossible to manage an unlimited number of transactions no matter how great the planning or target set by the organization. Organization which carries the operation should recognize the human factor such as bounded rationality before the works is carried out. Failure to recognize the human capacity or bounded rationality will affect the effectiveness of planning and can causes waste such as waste of time or delaying the work [16].

The potential for bounded rationality in construction transaction cost are required to recognize because the waste will influence the efficient operation of transaction due to limit capability of market because it is hard to foresee all of the possible contingencies and future problem. An example of bounded rationality in construction are the capacity of workers in the supplier organization that fail to meet the large quantity required by the focal company within short period. Generally, the present of human behaviour such as bounded rationality will jeopardize the effectiveness of work as it will increase the final price due to transaction cost waste. In the nutshell, the human behavioural assumption such as bounded rationality and opportunism behaviour are categorize as waste in transaction cost which will increase the transaction cost [14].

4.2.1.3. Procuring Complexity

According to [13], transaction cost or frictional cost are also affected by the procuring complexity and human behaviour. The reasons of the increases of price is because of numerous numbers of suppliers tend to increase the frictional cost incurred, thus increase the prices of transaction cost. Plentiful numbers of suppliers will also cause complexity in procuring raw material during transaction due to complexity of keeping numerous documents. Lower complexity transaction between suppliers and the company that would lead to lower down the transaction cost of the company due to lesser negotiation and communication cost, contracting cost and better problem tracing and solving due to efficient buyer-supplier interface.

Choi [13] has quoted by saying “When a focal company sets the reduction of transaction costs as a strategic goal, it generally focuses on reducing the number of suppliers rather than reducing the level of differentiation or the level of interrelationships among suppliers”. Example of manufacturer that has implemented the method of lesser suppliers are Electron, an electronic manufacturer which are able to reduce administrative cost or transaction by undergoing business operation with fewer suppliers [17].

5. Discussion of Findings

5.1. Wastages in transaction cost in construction industry

There are 5 types of wastages in transaction cost in construction industry between upstream and downstream supply chain network, i.e. non-value adding cost, in efficiencies used of resources, in-direct cost, unsatisfactory work and non-physical waste. All the wastages will affect the final price of goods and services in a project.

5.2. Opportunist behaviour

5.2.1. Consequences of opportunist behaviour in transaction cost within the supply chain network of Malaysia construction projects

The top rank consequence of opportunist behaviour in transaction cost is increases of prices, by taking advantageous through deceptive, cheating and lying to generate extra profits from vulnerable partners. Next, opportunist behaviour is also causing delay in delivering the project to the client because it tends to disturb the smoothness of the work. Last but not lease, opportunist behaviour within the supply chain network will damages the good relationship among them and the participants also stated that this relationship is important to ensure a long-term benefit relation. Opportunist behaviour by the supplier will causes the contractor to lose trust to the supplier and will affect to the increase of prices and will cause loss to the client. This idea is highlighted in the literature review by [18].

5.2.2. Risk of opportunism in transaction cost

Based on the discussion of the consequences of opportunist behaviour in transaction cost in construction industry, it can be deduced that the risk of opportunism transaction cost gathered during interview session is an additional information to the research. First and foremost, limited raw material and limited supplier causes the increases of price due to the influence of opportunist behaviour. Participant also added that risk of opportunism will increase when the raw material is limited and low number of competitive price due to limited number of available suppliers. Next, risk of opportunism will also increase when facing a situation where the contractor will have to buy ‘ad-hoc’ material because ad-hoc material requires the customization of order. In addition, the risk of opportunism behaviour will also increase when encountering with low number of available sub-contractor and due to opportunist behaviour of the intermediator when the person in charge tend to demand a higher price than usual.

5.3. The effects of bounded rationality that leads to wastages in Transaction Cost

Bounded rationality is being defined and analysed as capability to do work but are bounded with the capacity of working experiences, limited knowledge and information and bounded with a finite amount of time. This can be supported by a research made by a transaction cost economist, [12] which has stated that bounded rationality is the limit of human factor and their capacity and capability to make rational decision and evaluate all decision, and to work under limited time which results in unpredictable inadequate contracts. It is also known as capability to do work but bounded by external factors. External factor will limit the production rate of the worker with unforeseeable circumstances. However, according to the participant, unforeseeable circumstances will not affect the waste of transaction as the contractor may apply for an extension of time.

The effects of bounded rationality that existed in transaction cost are late delivery, unsatisfactory work and inaccuracy of estimation. This is because bounded rationality behaviour will delay the work due to bounded by the bounded rationality agent. Next, unsatisfactory work produced by the sub-contractor is one of the effects of bounded rationality in transaction cost because they will produce a poor-quality work. In addition, bounded rationality will also affect the transaction cost through inaccuracy of estimation of work because worker that are bounded by the experience and knowledge in estimating will produce a poor estimation of work. All these effects will lead to the production of wastages in transaction cost within the construction supply chain network.

5.4. The effects of procuring complexity that leads to wastages in Transaction Cost

It is mentioned that procuring building material from a sole distributor can reduce the cost by maintaining trust-based relation with the supplier. This is supported by the findings from research done by [13] and [17] where they identified that numerous numbers of suppliers tend to increase the frictional cost incurred, thus increase the prices of transaction cost. Furthermore, plentiful numbers of suppliers will also cause complexity in procuring raw material during transaction due to complexity of keeping numerous documents. However, it is completely contradict to the research made by [13] and [17] where 80% of the participant disagree that procuring material from sole-distributor will reduce the transaction cost. 100% of the participant tend to agree that procuring from various supplier will tend to get a lower price.

5.5. Suggestions to eliminate opportunist behaviour in Transaction Cost

The suggestion to eliminate the opportunist behaviour in transaction cost is important. First and foremost, wastage in opportunist behaviour can be reduced by reviewing the previous database of the supplier's services and transaction history. Next, opportunist behaviour can be eliminated through reviewing on the market prices from various supplier. the participant also added by stating product pricing survey from various company will help to find the material with the best price and with the best quality by comparing the competitive price of the goods and services.

In addition, participants also suggest a method to eliminate opportunist behaviour from the supplier are by doing intensive check by the site manager. This is because the supplier will always the supplier will always take an advantageous when the site manager is not aware. Last but not lease, participant has also added a suggestion to eliminate the opportunist behaviour by building a trust-based relation with the supplier. This is because trust-based relation with the supplier will generate benefit in a long-term relation with the supplier. By maintaining good relationship with the supplier, the contractor may find a good price of goods and services due to good business relation with the supplier. Supplier will provide a good service to the contractor and may offer a discount to ensure a long run business relationship.

5.5.1. Suggestions to eliminate bounded rationality behaviour in transaction cost

Based on the discussion of bounded rationality in transaction cost in construction industry, it can be deduced that the suggestion to eliminate the bounded rationality behaviour in transaction cost is important. First and foremost, wastage in bounded rationality behaviour can be reduced through severe forecasting and planning of material. By implementing proper material management, the contractor can forecast the estimated arrival of the material to the site. The participant has also added by stating the forecasting and planning of the

material are important to ensure the smoothness of the flow of the material are in the best price, with the best quality, at the right place and at the right time.

Next, the participant has also added a suggestion to eliminate bounded rationality behaviour due to late delivery of work from the sub-contractor is by penalizing the contractor through liquidated charges. The penalty and charges provide by the main contractor will help to control and maintain the schedule to complete the work within agreed duration. Finally is through estimating software. The software will ease the work of quantity surveyor by providing estimation of quantity with short period of time. By using estimating software, the quantity surveyor work will be no longer bounded by experience and knowledge in estimating.

6. Conclusion

From the analysis and interpretation of interview surveys, it is concluded that the implication of the finding implies that the identified data are crucial in eliminating waste in transaction cost within the supply chain network in Malaysia construction projects.

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