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A CONCEPTUAL MODEL FOR VALUE CHAIN MANAGEMENT IN CONSTRUCTION CONTRACTOR ORGANISATIONS

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ABSTRACT

Lean techniques focus on value maximisation while minimising waste. Waste is commonly interpreted as waste of material even though, waste in construction industry also relates to activities such as defects, movement, waiting time and processing. Such waste can be minimised through an in-depth understanding of the organisation. Herein, Value Chain Management (VCM) can be used to facilitate organisations to categorise the activities in terms of their value addition.

The generic value chain model developed by Porter in 1985 focuses on the manufacturing industry thus, a framework is required for contractor organisations based on which Value Adding Activities (VAAs) and non-VAAs can be identified. This paper is aimed at proposing a conceptual model for VCM in contractor organisations.

Three case studies were conducted in selected contractor organisations and data was collected through fifteen semi-structured interviews. Collected data was analysed using content analysis.

Altogether, 46 VAAs were identified classified under four primary functions and six secondary functions. The findings were used to develop a VC model applicable to contractor organisations based on Porter's generic VC model. This in turn could be used by contractors to adopt strategies to enhance Value Adding Activities (VAAs) and to minimise non-VAAs.

KEYWORDS

Conceptual model, contractor organisations, value adding activities, value chain, value chain management.

INTRODUCTION

Waste in construction industry is inevitable due to the complex nature of its activities (Broft, Badi andPryke2016). Waste predominantly results due to lack of resources and

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information, poor planning, inappropriate methods, ineffective control and issues relating to decision making (Serpell, Venturi and Contreras 1995). Activities carried out in an organisation has a major impact on waste creation. Yet, it is common that managers have limited perspective on the factors that contribute to creation of waste (Ballard and Howell 1998). Even if many of the waste creating factors are not visible, the identification of such can provide valuable information for an organisation, and in turn the industry, to improve (Alarcon 1997).

According to Rahman, Wang and Lim (2015), value stream mapping, lean management, construction process analysis, mud a walk and spaghetti diagrams are some of the commonly adopted tools for waste identification. In addition, Value Chain Management (VCM) can also be used since the concept highlights the importance of focusing on the value of each activity that contributes to the delivery of goods and services (Broft, Badiand Pryke 2016).

However, Lindfors (2000) has argued that companies find it difficult to differentiate the Value Adding Activities (VAAs) with non-VAAs. The models developed so far for VCM focuses on manufacturing industry rather than the construction industry. To address this gap, this paper, based on case study research, develops a conceptual model for VCM in construction contractor organisations.

LITERATURE SYNTHESIS

VALUE CHAIN (VC) AND VALUE CHAIN MANAGEMENT (VCM)

VC in an organisation is identified as the "activities" that are undertaken in order to deliver a valuable product or a service to the end user (Porter 1985). Thus, VC provides a view of an organisation in terms of its value generation process (Rowe, Mason, Dickel, Mann and Mockler 1993). The underlying principle behind VC is that, value creation of a company cannot be recognised as a whole and hence, needs to be broken down into activities (Porter 1985).

Each activity that creates value in the aforementioned process is identified as a VAA. According to Han (2008), a VAA is defined as "an operational effort that realise project requirements as defined by the project contract through the transformation of information and/or material into final product". While VC of a firm is recognised as the activities, VCM is simply identified as managing the VC of the organisation. Accordingly, VCM acts as "a strategic business analysis tool" that can be "used for the seamless integration and collaboration of VC components and resources" (Technopedia 2017).

GENERIC VALUE CHAIN (VC) MODEL

VC enables a firm to disaggregate its strategic functions, providing a better understanding in terms of cost and value (Nguyen and Kira 2001; StabellandFjeldstad 1998). The underlying rationale behind decomposing is that the activities are the building blocks which are used to produce a product that generates value (StabellandFjeldstad 1998). Even though all the activities need to be taken into account in the VC development of an organisation, the activities considered should either result in a considerable proportion of cost, or have a significant impact on the value (Porter 1985; StabellandFjeldstad 1998).

The generic VC model developed by Porter (1985) provides a useful foundation for identification of a firm's VC. According to Ensign (2001), the model shows the manner in which a product adds value while it moves along the production process. Thus, this can be used as a template to identify the strategic improvements or opportunities within a firm in order to eliminate waste. Although, Porter's generic VC model provides a foundation for identifying value creating activities for a particular firm in an industry, its direct application to the construction industry has come under question. This is mainly due to the significant differences that the construction industry possesses in terms of the process and the parties involved compared to the manufacturing industry. Indeed, intricate characteristics of the industry mean that construction companies find it difficult to differentiate the VAAs with non-VAAs (Lindfors 2000).

This paper, therefore, addresses this gap of lack of research analysing VCM practices in construction industry despite its proven benefits in other industries. Herein, Kearney (2008) has stated that amongst the different stakeholders in the construction industry, the 'contractor' accounts for a higher cost proportion of a construction project. Accordingly, 'contractor' has a greater opportunity to add value to the VC of the construction process (Miles 1995). Therefore, this research focuses on contractor organisations in order to identify the VAAs.

RESEARCH METHODOLOGY

Case study was identified as the most appropriate approach for this research as it allowed in-depth analysis of the activities of contractor organisations focusing upon the value creating process.

Case study research may be carried out in the form of a single case or multi-case approach (Yin 2009). Single case study is adopted in circumstances with similar nature whereas multi case study is undertaken to analyse the collective features (Hyett, Kenny and Dickson 2014). Since activities of construction contractors vary from firm to firm, multi-case approach was adopted using three contractor organisations as the cases. The focus was limited to large-scale contractor organisations only since the activities in the firm are standardised to a certain extent in this type of organisations (Chan 2012). On the other hand, in small and medium scale contractor firms, the activities in the firm and the costs are sensitive to the projects undertaken (Eksteen and Rosenberg 2002). Thus, 03 organisations were selected using convenient sampling from the contractor organisations graded CS2 by the Construction Industry Development Authority (CIDA) of Sri Lanka (which denotes the largest scale construction contractors in the country with the financial, technical and other resource capabilities to bid for projects over LKR 3000 million (CIDA 2009).

Semi structured interviews were used as the primary technique of capturing data until the point of data saturation. In selecting respondents for the interviews, attention was given to gaining a clear picture of the activities throughout the overall process of the organisation. Altogether, 15 interviews were conducted within the 03 cases (refer Table 1). The main purpose of the interviewees was to identify the VAAs undertaken by the contractor organisation in order to add value to the client.

Table 1: Details of Interviewees from the 03 Cases

Interviewee		Designation	Experience
Case Study 1 (CS1)			
1	C1A	Senior Quantity Surveyor	+15 years
2	C1B	Manager in Contract Administration	+20 years
3	C1C	Quantity Surveyor	+10 years
4	C1D	Human Resource Manager	+15 years
5	C1E	Marketing Manager	+20 years
6	C1F	Legal Officer	+15 years
7	C1G	Information and Technology Manager	+15 years
8	C1H	Finance Manager	+15 years
9	C1I	Head of Internal Audit Committee	+20 years
Case Study 2 (CS2)			
1	C2A	Managing Director	+25 years
2	C2B	Director of Marketing	+20 years
3	C2C	Project Director	+20 years
Case Study 3 (CS3)			
1	C3A	Deputy General Manager	+30 years
2	C3B	Project Manager	+20 years
3	C3C	Chief Quantity Surveyor	+25 years

The interviews were digitally recorded with permission, transcribed and analysed using content analysis to identify VAAs within the contractor organisation. Content analysis is a technique that is commonly used in the qualitative research since the approach intersects the qualitative and quantitative measures (Duriau, Reger and Pfarrer 2007; Hsieh and Shannon 2005). Further, content analysis is a step by step analytical approach which aims at enhancing the validity and the reliability of the qualitative data collected (Walliman 2011). The research used QSRNVivo (version 11) software programme to conduct content analysis.

DATA ANALYSIS AND RESEARCH FINDINGS

DEVELOPMENT OF THE CONCEPTUAL MODEL

The generic VC model developed by Porter in 1985 focuses on manufacturing industry and is the commonly adopted template under VCM (Hubbard, Zubac, Johnson and Sanchez 2009). Thus, this generic VC model was used as the basis in developing a VC model for contractor organisations.

Through the case study findings, it was revealed that the VAAs of contractor organisations can be mainly categorised into two categories as primary VAAs and secondary VAAs. Herein, the primary VAAs are those activities that are directly linked to the final output of the firm. The supporting activities or secondary VAAs on the other

hand, facilitate the company to perform the primary activities. Accordingly, the success of primary activities depend upon the supporting activities.

The case study findings also revealed that the primary activities of a construction organisation can be classified under four phases namely; the pre-tendering stage (which involves the activities carried out to obtain the project), the tendering stage, the construction stage and the post construction stage. Furthermore, six categories of secondary VAAs were also identified as finance and auditing, human resource management, legal, procurement, technology and development, and other. The VAAs that were not specific for the first five categories of secondary activities were grouped under the 'other' category. The proposed VC model for contractor organisations developed using the aforementioned findings is shown in Figure 1.

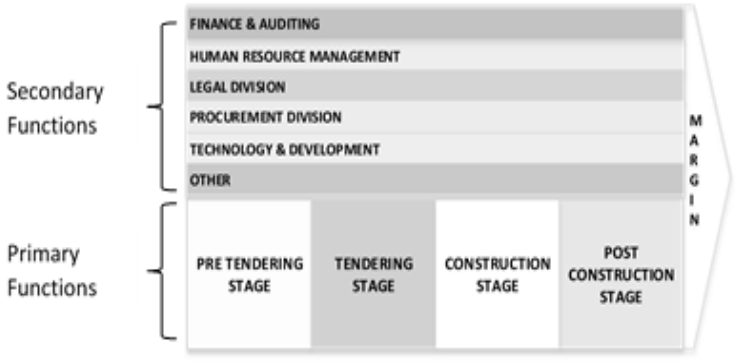

Figure 1: Proposed VC Model for Contractor Organisations

The 'margin' towards which the activities are pointed in Figure 1 implies the difference between the costs that are incurred and the price that the customer is willing to pay (StabellandFjeldstad 1998). Hence, the margin relies on the capability of a firm to manage the relationships among the activities (Durisova 2010). The VAAs identified under each of the above categories are discussed in the next section.

VAAS IN CONTRACTOR ORGANISATIONS

Altogether, 46 VAAs were identified for contractor organisations through the case studies. Table 2 and Table 3 presents these identified VAAs categorised under the different primary and secondary functions as identified in Figure 1.

Table 2: VAAs Identified Under Primary Functions

	Value Adding Activity (VAA)	No. of Respondents that Mentioned the VAA			
		CS1	CS2	CS3	Total
Pre-tendering Stage (Marketing)					
1	Developing relationships with potential clients	1	1	1	3
2	Marketing to create awareness of the company	1	1	0	2
3	Gathering and analysing data of possible projects to bid	0	0	1	1

	Value Adding Activity (VAA)	No. of Respondents that Mentioned the VAA			
		CS1	CS2	CS3	Total
No. of VAAs identified in the case (Total No. of VAAs in category)		2(3)	2(3)	2(3)	
Tendering Stage					
1	Participating in pre-bid meeting by the most suitable person	1	1	2	4
2	Participating in site visits by the most suitable person	2	1	1	4
3	Providing value engineering proposals at pre contract negotiations	2	0	1	3
4	Consulting construction experts	1	1	1	3
5	Assessing suppliers in terms of reliability and availability	1	0	1	2
6	Carrying out surveys in site	1	1	0	2
7	Providing an estimate with high accuracy	1	1	0	2
8	Selecting methods and mechanisms to enhance efficiency	0	1	1	2
9	In depth planning at tendering stage to reduce risk	1	1	0	2
10	Cross checking the quantities in the BoQ to compensate from rates	1	0	0	1
11	Maintaining a database of the market rates which is updated	0	1	0	1
12	Referring post project analysis of completed projects	0	1	0	1
No.of VAAs identified in the case (Total No.of VAAs in category)		9(12)	9(12)	6(12)	
Construction Stage					
1	In detail planning of material, labor and plant and machinery allocation	1	1	2	4
2	Monitoring actuals vs planned in terms of budget, resources and time	1	2	1	4
3	Maintaining proper records	0	1	1	2
4	Planning the cash flow of the project to suit the method of payment	0	1	1	2
5	Planning the logistics of materials	0	2	0	2
6	Using new technology in construction	1	0	1	2
7	Enabling high level of client involvement in the process	0	1	0	1
8	Planning the activities of the project for a shorter period of time than the contract period	0	1	0	1
No. of VAAs identified in the case (Total No. of VAAs in category)		3 (8)	7(8)	5(8)	
Post Construction Stage					
1	Undertaking post project analysis and proper communication of lessons learned	2	2	1	5
No. of VAAs identified in the case (Total No. of VAAs in category)		1(1)	1(1)	1(1)	

Table 3: VAAs Identified Under Secondary Functions

	Value Adding Activity	No. of Respondents that Mentioned the VAA			
		CS1	CS2	CS3	Total
Finance and Auditing					
1	Conducting internal audits	1	1	1	3
2	Establishing financial controls	1	1	1	3
3	Managing the working capital	1	1	0	2
4	Monitoring financial matters of the project	0	2	0	2
No. of VAAs identified in the case (Total No. of VAAs in category)		3(4)	4(4)	2(4)	
Human Resource Management					
1	Providing job related training and development	1	3	1	5
2	Conducting professional-development programs	1	2	1	4
3	Establishing a recruitment plan	1	1	1	3
4	Enhancing staff welfare	1	0	1	2
5	Offering a financial incentive	1	0	1	2
6	Establishing a disciplinary procedure	1	0	0	1
7	Maintaining the organisation culture in the project	0	1	0	1
No. of VAAs identified in the case (Total No. of VAAs in category)		6(7)	4(7)	5(7)	
Legal					
1	Preparing contract agreements to minimise ambiguities	2	2	1	5
2	Consulting legal experts	0	1	1	2
3	Drafting documents for court cases, joint ventures etc.	1	0	0	1
No. of VAAs identified in the case (Total No. of VAAs in category)		2(3)	2(3)	2(3)	
Procurement and Logistics					
1	Establishing an effective supply chain and logistics	1	2	1	4
No. of VAAs identified in the case (Total No. of VAAs in category)		1(1)	1(1)	1(1)	
Technology and Development					
1	Integrating departments in the organisation	0	1	2	3
2	Using computer software in project management	1	1	1	3
3	Carrying out research to provide innovation	1	0	1	2
4	Developing new IT systems to minimise processing time	1	0	1	2
5	Backing up data	1	0	0	1
6	Introducing new service providers to the client	0	1	0	1
No. of VAAs identified in the case (Total No. of VAAs in category)		4(6)	3(6)	4(6)	
Other					
1	Facilitating access to subject-related books and journals	1	0	0	1
No. of VAAs identified in the case (Total No. of VAAs in category)		1(1)	0(1)	0(1)	

Altogether, 24 VAAs were identified under the primary functions. Among the four stages (refer Figure 1), the highest number of VAAs were identified under the ‘tendering stage’ and the second highest were under the ‘construction stage’. These account for 43%

(20 out of 46) of the total identified VAAs. As a result, the findings imply that higher amount of value can be generated in tendering stage and during the construction.

Three VAAs were identified under 'pre-tendering stage'. In this stage, 'developing relationships with potential clients' was identified as a VAA in all 03 cases. This may be because, the ability to add value arises only if a project is awarded the contractor. Among the VAAs identified under 'tendering stage', 'participating in pre-bid meetings by the most suitable person' and 'participating in site visits by the most suitable person' were identified as VAAs in all 03 cases. The highest number of VAAs in the tendering stage (i.e. 09 out of 12) were found in CS1 and CS2 while the least were found in CS3. Further, activities 'consulting construction experts' and 'providing value engineering proposals at pre-contract negotiations' were also given a high level of importance by the interviewees. In terms of 'construction stage', the highest number of activities were found in CS2 (i.e. 7 out of 8) and the lowest in CS1. In this stage, the 'in detail planning of material, labor and plant and machinery allocation' and 'monitoring actuals vs planned in terms of budget, resources and time' were identified as VAAs in all 03 cases. Under 'post-construction stage', interviewees from all 03 cases pointed out that the experience gained and the lessons learnt are highly value creating activities. Thus, 'Undertaking post project analysis and proper communication of lessons learned' was identified as an essential VAA during this stage to allow project learning to be shared throughout the organisation. It was how ever noted that this particular VAA cannot add value to the current project but will add value to the future projects.

Under the secondary functions, altogether 22 VAAs were identified under the six categories shown in Figure 1. The highest number of VAAs were identified under 'human resource management (HRM)', whereas, the least number of VAAs were identified under 'procurement'. One VAA was classified under 'other'.

Altogether, four VAAs were identified under 'finance and auditing'. 'Conducting internal audits' and 'establishing financial controls' were identified as VAAs under this category in all 03 cases. Seven VAAs identified under the 'HRM' category. The highest number of VAAs under HRM (i.e. 06 out of 07) were identified from CS1, whilst only 4 and 5 VAAs were found in CS2 and CS3 respectively. Among the activities identified, 'providing job-related training and development', 'conducting professional-development programs' and 'establishing a recruitment plan' were recognised as VAAs in all 03 cases. Under the 'legal' category, 'preparing contract agreements to minimise ambiguities' was identified as a VAA in all 03 cases. This particularly highlights the attention required in making contract agreements with parties such as sub-contractors and suppliers. Under the 'procurement and logistics' category, 'establishing an effective supply chain and logistics' was identified to have the ability to provide value to the client in all 03 cases. As noted by some interviewees, an effective procurement mechanism can prevent delays and also reduce storage costs. Six VAAs were identified under the 'technology' category. 'Using computer software in project management' was identified in all 03 cases under this category.

CONCLUSIONS AND RECOMMENDATIONS

This research focused on developing a conceptual model for VCM in contractor organisations. The findings revealed that the VAAs of a contractor organisation can be classified mainly into two as primary (core) and secondary (supporting) activities. Results also showed that primary activities can be further categorised based on the phases of the project as pre-tendering, tendering, construction and post-construction. Altogether 24 VAAs were identified under the primary functions where the highest number of VAAs were found under the 'tendering' phase. Similarly, secondary activities were classified under six sectors; i.e. finance and auditing, human resource management, legal, procurement, technology and development, and other. Altogether, 22 VAAs were identified under secondary functions, out of which the highest were from the HRM category.

The research makes a unique contribution to knowledge by proposing a VC model applicable to contractor organisations based on Porter's generic VC model. The findings of this research can be used by contractor organisations in undertaking VCM in their organisations to gain an in depth understanding in terms of the value addition of the activities, ultimately leading to enhanced value for construction clients.

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