Application of supply chain management in construction industry

Abstract:

Supply chain coordination has become a critical success factor and effectively improved the performance of organizations in various industries. The construction industry in general is characterized with high fragmentation, low productivity, cost and time overruns, and conflicts. The application of supply chain management in construction industry may provide a new solution for resolving these problems from systems perspective. Coordination is the core issue to improve construction performance in construction supply chain (CSC). In this paper, the concepts of CSC are expounded. Furthermore, the inter-organization problems that affect CSC coordination are identified. Innovations and best practices focusing on CSCM are proposed in this paper.

Key words: construction supply chain, coordination, supply chain management

1. Introduction

Supply chain coordination has become a critical success factor for supply chain management (SCM) and effectively improving the performance of organizations in various industries. Coordination refers to the integration of different parts of an organization or different organizations in supply chain to accomplish a collective set of tasks and to achieve mutual benefits[1]. The construction industry in general is characterized with high fragmentation, low productivity, cost and time overruns, and conflicts compared with other manufacturing industries. There are so many people and parties involved in the construction, e.g. client, vendor, general contractor, subcontractor, designer, supplier and so on. It is difficult to coordinate and manage so many parties in construction.

At present, a small but increasing number of construction organizations are beginning to adopt supply chain management (SCM) to improve their performance and to address their adversarial inter-organisational purchaser-supplier relationships and fragmented processes[2]. However, the
application of SCM in construction is still limited and the importance of CSCM (construction supply chain management) is still ignored by the participants in construction. This paper talked about how SCM can be applied in the construction industry.

2. Concepts of CSC (Construction Supply Chain)

CSC consists of all construction processes, from the initial demands by the client/owner, through design and construction, to maintenance, replacement and eventual demolition of the projects. It also consists of organizations involved in the construction process, such as client/owner, designer, General Contractor (GC), subcontractor, and suppliers. CSC is not only a chain of construction businesses with business-to-business relationships but also a network of multiple organizations and relationships, which includes the flow of information, the flow of materials, services or products, and the flow of funds between owner, designer, GC, subcontractors, and suppliers [3,4]. A typical model of CSC is shown in Fig. 1. In the model of CSC, GC is the core of the CSC. And the owner and designer are the other two main partners in CSC. Excepting the direct suppliers of GC, subcontractors are also regarded as the suppliers of GC; meanwhile, subcontractors have their own suppliers.

Although a number of researchers have provided definitions for CSC management (e.g., Refs. [5,6]), for consistency, this research defines CSC management as Xiaolong Xue,[1]: CSC management is the coordination of interorganizations’ decision making in CSC and the integration of key construction business processes and key members involved in CSC, including client/owner, designer, GC, subcontractors, suppliers, etc. CSC management emphasizes on long-term, win/win, and cooperative relationships between stakeholders in systemic perspective. Its ultimate goal is to improve construction performance and add client value at less cost.
3. Inter-organization problems in CSC

Although there have been many changes in the construction industry as a result of the development of technology and culture over the last decades, CSCs do not seem to have changed much. Many problems still exist in CSC. According to Ref. [7], the major problems originate at the interfaces of different participants or stages involved in the CSC. The problems are caused by myopic and independent control of the components of CSC.

- Designer --- General contractor

Love et al. [8] and Mohamed [9] noted the highly fragmented characteristics of the construction industry. For example, the separation of design and construction, lack of coordination and integration between various functional disciplines, poor communication, etc., are the important impact factors causing performance-related problems, such as low productivity, cost and time overrun, conflicts, and disputes.

- Owner --- Designer/General contractor

Adversarial relationship between owner and designer/general contractor is an important factor which causes the poor performance of the construction and conflicts. There are many reasons. It mainly is caused by the narrow minded win/lose attitudes; prime focus on bid prices (with inadequate focus on life-cycle costs and ultimate value) and the inadequate recognition of the
sharing of risks and benefits.

- **General contractor --- Subcontractors**

Because general contractor manage the behaviors of subcontracts and pay for them, it also seemed to be an adversarial relationship between GC and subcontractors. The reasons include power domination and frequent contractual noncommitments which result in adverse performance track records with poor quality, conflicts, disputes, and claims. Minimal or no direct interactions are considered as another factor resulted in adversarial relationship. Frequent and direct interactions are a better way to foster sustainable long-term relationships.

- **Contractor --- Suppliers**

There are conflicts existing between contractors and suppliers. Contractors do not often have a proper plan of material. When the materials run out, they begin to buy some in a hurry. Also, they may do not spent a lot of time to select the suppliers, which will result in the usage of bad quality of materials. Contractors should have more communications with suppliers. Supply contracts should be transparency coupled with inadequate information exchanges.

In order to overcome the shortcomings (weak links) of CSC and resolve the problems in CSC, and to further improve the performance of the whole CSC, this research presents some methods and practices to integrate the whole CSC.

### 4. Innovations and best practices focusing on CSCM

#### 4.1 Incentive/disincentive arrangements

Payments are generally structured to correspond with contractual performance in which incentive/disincentive measures can be arranged easily. Various incentives are used to encourage the contractors to achieve improved performance and increased productivity. For instance, in a construction contract, special incentive/ disincentive arrangements can be made for safety performance. Of course, the incentive/ disincentive arrangements should be consistent with legal and other contractual requirements. Many researches have discussed the significance of incentive/disincentive schemes with some examples from construction projects.

#### 4.2 Performance linked contractor selections

The selection of contractor is very important since it is the main part to construction. In general,
clients choose contractors according to the history records of performance, for example, what kind of buildings they are good at, how is the history construction quality and so on. If the client has the history cooperative experiences with the contractor, it would much easier to make a decision. In traditional approaches, the client’s roles as ‘watch dog’ involve supervision of contractor performance and control measures (such as warning letters and penalties). Certain approaches introduced some incentives (e.g. awards, bonuses) as motivators for good performance. However, some clients, especially some bi companies, knit contractor performance into their selection strategies. Generally, they will do a search on the history performances of contractors and list. This list will be evaluated by experts. If the result is good, then the contractor can be piror to entry their database records, which would be srovided additional opportunities.

4.3 Conflict and dispute management

Conflicts and disputes are common in most construction projects. Although several dispute minimization measures such as partnering and alliancing are now being used in construction projects, conflicts and disputes still can not be avoided completely. Furthermore, several academic research initiatives have led to the developments of various tools for predicting/forecasting claims/disputes and decision-making in disputes/claims. Some such academic research include claims focus indicators (as developed by Yogeswaran and Kumaraswamy [10]), contractual methods for dispute avoidance/resolution[11] and so on.

4.4 Long-term relationships and ‘keiretsu’

Long-term relationships would improve cost and time performance and conflicts/claims would be reduced. In general, the relationships between Japanese organizations (as business partners) are strongly bound by ‘keiretsu’ arrangements [12,13]. Keiretsu could be defined as a network of businesses that own stakes in one another as a means of mutual security and usually include large manufacturers and their suppliers of raw materials and components. The key characteristics of Japanese keiretsu are: (a) cross-holdings in shares and other assets (such as patents), (b) multi-firm production networks, (c) long-term relational contracting histories, (d) joint R& D efforts, and (e) exchange of skilled staff.

Many general studies reflect a fragmented nature, volatility and adversarial relationships among organizations in many western and other societies. However, some ‘keiretsu’ experiments in USA achieved good performance in general procurements [13]. Similar changes should be beneficial in
construction procurements as well. Some form of ‘keiretsu’ relationships prevail in some Build-Operate-Transfer (BOT)-type projects as clients participate together with main contractors as BOT consortia shareholders in those projects [14]. Furthermore, some major construction contractors established ‘keiretsu’-type links with their subsidiary concerns for supply and other subcontracts. Similar ‘keiretsu’-type relationships could be mobilized for reinforcing links in construction supply chains.

Recent moves towards ‘alliancing’ contracts, for example in the recent National Museum Project in Australia [15] can be said to contain elements of such a keiretsu type approach. For example, each alliance partner has a greater ‘stake’ in the project, which leads to stronger commitments and closer bonds.

5. Conclusion

Many researches and practices have proved that supply chain coordination has become the crucial strategy for successful SCM and effectively improving the performance of organizations in various industries. The research finds that there are many interorganization problems in CSC. CSCM provides a solution to resolve the problems and improve the performance of construction. Innovations and best practices focusing on CSCM are proposed in this paper. Some practices have been applied in the construction and have received many good results in reality. This paper is just an initial effort, some issues still need to be addressed. For example. How to improve the application of SCM in construction industry, is really a challenge. There are still many issues that need to do further research.

6. References


