

Construction Supply Chain System Based on the General Contractor

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Abstract Due to the fierce competition in construction industry, many enterprises begin to focus on the intra-industry cooperation and the application of supply chain management in construction industry is inevitable. This paper discusses the status of construction supply chain and contracting model of the large-scale projects, and introduces the information management, logistics management and risk management in construction supply chain. Finally, the paper studies the role of general contractor in the supply chain and presents some measures to improve the practical application of supply chain management in construction industry.

Key words Supply chain management; Construction supply chain; General contractor; Logistics

1 Introduction

It is well recognized that supply chain integration can reap many benefits for enterprises. In the construction industry, more and more contractors tend to rely on the resource of suppliers and subcontractors, it is necessary for contractors to build interactive relationships with other partners in the construction supply chain. The construction supply chain related to the knowledge of engineering, logistics, management science and other aspects of knowledge, it also needs collaboration of suppliers, owners, designers, contractors, subcontractors and other participants, all of this make the management in construction supply chain becoming more complicated. Based on the above analysis, we will make further inquiry of applications in the construction industry from the perspective of general contractor.

2 Development of Construction Supply Chain

As the complexity of the construction process, the application of supply chain management in construction is not so popular than the automotive manufacturing and retails. In the late 20th century, the US once integrated some successful cases which used in the manufacture into models to encourage other industries to learn from the thought of supply chain management. Nowadays, industrialization in construction is becoming more and more popular, for example, prefabrication and onsite assembly are becoming common practice^[1]. It entitled construction industry to shorten construction cost, but the space of operating efficiency is still limited. Lauris Koskela proposed to apply lean principles in construction project at first. Up to now, besides lean thinking, there are many theories applied in manufacture originally have been put into use in construction supply chain, like agility, business process reengineering, etc. Nowadays, main contractors have become increasingly reliant on other actors in the construction supply chain^[2].

3 Overview of Engineering Contract Model

With the development of social division, the number of construction projects managed by clients themselves has been decreasing, especially for large-scale projects. Clients need to integrate advantages of each participant, particularly the contractor's ability to provide integrated services. The current prevailing international management of major projects is mainly engineering procurement construction (EPC) and project management contractor (PMC). The PMC model refers to the project management contractor undertake the project, but only responsible for the whole process of project management, and subcontract the concrete work, like construction and design. That is, the PMC determines the general contractor. Therefore, whether under PMC or EPC project management models, the logistic services, like equipment procurement, inventory, and transportation, installation, are all carried out under the guide of general contractors^[3].

In the construction supply chain, different project management models will have different effects in the construction supply chain, only by adopting the appropriate model can the clients achieve the unity of the work involved. Taking the applicability of supply chain management in the construction industry into account, we analyze the construction supply chain system which focuses on the general contractor.

4 Model of Construction Supply Chain Based on the General Contractor

The main work of the general contractor in the construction supply chain is as follows: integrate the resource of suppliers and subcontractors to make full use of it, and coordinate the relationships between project management contractors or clients to enhance the whole operational efficiency of the supply chain. For the general contractor, the profits of concrete construction is gradually decreasing, so more and more companies moving operations to the early stage of project process, and the focus on the profits has shifted. Therefore, the general contractor in the construction supply chain should establish long-term and stable partnerships with upstream and downstream enterprises so as to better play the core competitiveness. Figure 1 is the construction supply chain model based on the general contractor.

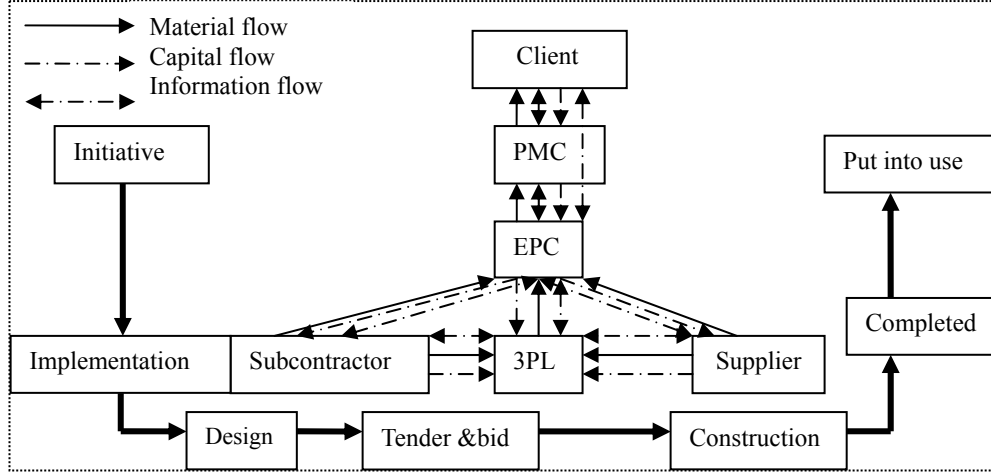


Figure 1 Construction Supply Chain Model Based on the General Contractor

From the picture above, we can know that the construction supply chain system based on general contractor is a chain system that intends to meet the demand of clients, integrate the material, information and capital flow under the assistance of information management, and make an integrated management between clients, suppliers, subcontractor or other participants. Construction supply chain management throughout the whole process of project is to achieve win-win relationships with relevant participants. At the initiative stage of the project, the clients may appoint a professional project management company to supervise the project. They can also directly select the general contractor to responsible for the design, bidding, and construction of the project. At the implementation stage, the general contractor responsible for the procurement of materials and the monitoring of project, as to the implementation of specific projects and logistics operations, they can be supported by suppliers, subcontractors or professional logistics service providers. Since the technical complexity of large projects, the general contractor tends to entrust a professional third party logistics company to provide services. The application of the construction supply chain based on general contractor in the practical engineering projects is as follows.

4.1 Information management

As the construction project is a dynamic management, general contractor has a large amount of information communication between clients (PMC), subcontractors and suppliers. The junction of different participants in the construction supply chain is most vulnerable to have information bias with upstream and downstream enterprises. Therefore, when the general contractor selects the supply chain partner, they will consider the information sharing ability as an important criterion.

4.2 Logistics management

Engineering Logistics is the logistics enterprises focusing on the construction project in order to provide logistic service during the whole process. Through the professional services provided by logistics companies, the investors can get security and convenience. At the same time, the cost of the project will be lowered, and the project will be completed on schedule. The activities of engineering logistics exist in the whole supply chain, making the construction in the whole process seamless docking. As the center of information, logistics and engineering settlement in the construction supply chain; general contractor should communicate with other participants actively and make good preparations for the project. Meanwhile, the partners in the supply chain should also cooperate with others by joint business and sharing information.

In addition, most construction materials and semi-finished goods piled up at the construction site; making the logistics management at the construction site is pretty important in the construction supply chain management. Construction subcontractors and suppliers can integrate their respective logistics activities together, relying on highly specialized third-party logistics companies to implement a joint distribution (Figure 2). Logistics companies can also responsible for the cleaning of construction and demolition waste at the site, reduce one-way transportation, increase the cycle of loading rate and resource utilization.

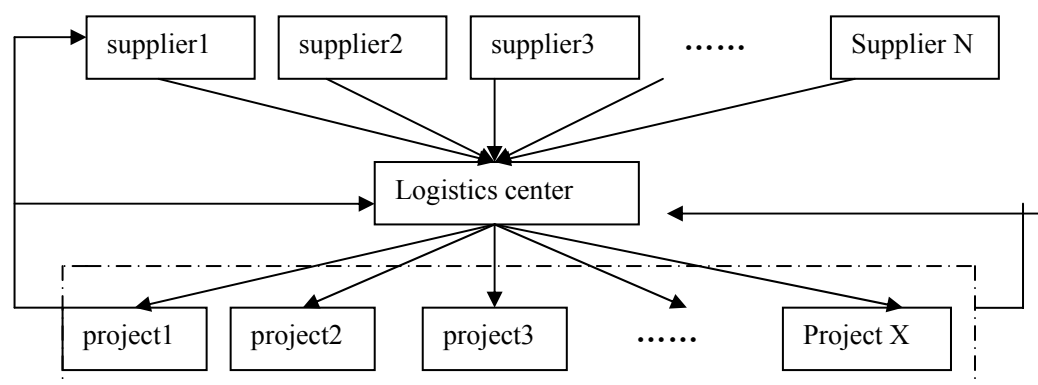


Figure 2 Joint Distributions^[4]

4.3 Risk management

The risk in the supply chain can be divided into internal and external risk. The external risk is mainly the environmental, economic, political and social uncertainties; the internal risk is primarily internal friction in the supply chain^[5]. It mainly refers to the uncertainties that influence schedule, quality, cost in the projects from general contractor to subcontractors and suppliers. The awareness of risk in the construction supply chain reduced step by step along the project managers, general contractors, subcontractors, suppliers. What's more, because of the "bullwhip effect" exists, when the information passed from client to the supplier, it directly increases the risk in the construction supply chain. Therefore, the general contractor should control the risk in advance and strengthen the awareness of partners in the supply chain during the construction process.

5 Role of General Contractor in Construction Supply Chain

5.1 Improvement of the logistics evaluation system

Supply chain is a unified whole, when the enterprise integrated with each other, definitely involves the integration of multiple functional activities. There exists a main problem in the construction industry, which is most partners in the supply chain always work on their own way; they haven't formed a good cooperative environment. The general contractor should pay attention to the cost formed in the logistics activities during the construction process, and make well-developed evaluation index system to reduce these cost so as to meet the requirements of logistics integration in supply chain. When the general contractor selects the supplier, they should also consider improving the relevant evaluation details of the supplier selection.

5.2 Construction of a close partnership with upstream and downstream enterprises

The temporary supply-chain networks that general contractor formed in the project making transaction costs and compliance risks still exist, this can not come up to the demand of close interaction in the construction supply chain. Therefore, the general contractor should choose the right suppliers and subcontractors; make communications on the control of cost, schedule and quality with them frequently in order to establish long-term strategic cooperative partnership. General contractor can implement concurrent engineering so that suppliers can join in the bidding stage, and make tailored plan for the project to reduce alternation during the construction. Meanwhile, the general contractor can select a professional third party logistics companies to make up each other's deficiencies. In addition, to maintain long-term cooperation relationships between the suppliers and subcontractors, it is important to stimulate them by establish a stable risks and rewards sharing mechanism.

5.3 Establishment of an information platform to enhance communication

The efficiency of the construction supply chain mainly comes from coordination among the

members in the supply chain. While information sharing is the base of coordination, the information level of supply chain members is different. In the construction supply chain management, because of the large amount of information, it is complex and dynamic, plus information asymmetry, if not taken seriously, will directly lead to the integration difficulties of the whole industry. Therefore, it is not only for general contractor in the construction supply chain to improve their information ability, but provide a good project management information platform to help the parties involved improve their level of information. By doing this, they can promote the standardization of construction supply chain together.

6 Conclusions

In this paper, we described how supply chain can be used to integrate clients (PMC), suppliers and subcontractors together based on the main contractors. Adoption of construction supply chain should enhance unity awareness through cooperate with other participants to reduce the construction cost and construction period. Due to the complex nature of the construction supply chain, besides, there is material flow, capital flow and information flow during the process, the general contractor should value some abilities of the cooperator, like information sharing and activity integrating. As a part of the construction supply chain, general contractor should build a construction supply chain integration and collaboration. At present, the thought of construction supply chain in the large-scale projects has an initial application. However, contrast to the applications in manufacturing and retail, supply chain management in the construction is still in development stage, need a further research.

References

- [1] Nenad Čuš Babič, Peter Podbreznik, Danijel Rebolj. Integrating Resource Production and construction using BIM[J]. *Autom. Constr.* (2009), doi:10.1016/j.autcon.2009.11.005
- [2] Ruben Vrijhoef, Lauri Koskela. The Four Roles of Supply Chain Management in Construction [J]. *European Journal of Purchasing and Supply Management*, 2000,(6):169-178
- [3] Wang Nuo. Brief Introduction of Engineering Logistics [M].Beijing: Chemical Industry Press, 2007 ,(7): 31-32(In Chinese)
- [4] M. Loosemore, C.S.McCarthy. Perceptions of Contractual Risk Allocation in Construction Supply Chains[J]. *Journal of Professional Issues in Engineering Education and Practice* .ASCE, 2008,(1):95-105
- [5] Laisang Si (Lysons, K.), Farrington (F / arrington, B.). Procurement and Supply Chain Management [M]. Translated by Ju Lei, Wu Lisheng, Zhang Jin. Beijing: Electronic Industry Press. 2007,(6):79-80(In Chinese)