Research on Risk Analysis and Control of Construction Supply Chain

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Abstract: The article first introduces the connotation of risk management in construction supply chain. It analysis the risk of the construction supply chain detailed. And it proposes different risk control strategy of construction supply chain to improve supply chain coordination, reduce risk and losses.

Keywords: construction supply chain; risk analysis; risk control

I. The Connotation of Risk Management in Construction Supply Chain

The risk of construction supply chain is the uncertain factors which infect the normal operation during the process of construction chain, bring loss for the member companies in the chain, and bring adverse impacts on the construction project's period, quality, investment and safety. The risk management in construction supply chain is the core company and its member companies in the supply chain who use the detail risk management instruments to deal with the uncertain factors appearing in operation process of supply chain; while the detail operation process is to recognize and evaluate various possible risk factors existing in the operation process of the construction companies' supply chain, at the same time, to take measure accordingly to control and avoid potential risks so as to ensure its normal operation and reach the final objective of the supply chain.

According to the structure and function of construction supply chain, it has the following features:

The construction supply chain is concentrated, and all the materials need to be shipped to the construction site to assemble. The product of the "Construction factories" is unique. But in manufacturing factory it always product through the bulk production, then sell them to users.

Except some minority, construction supply chain is usually temporary supply chain. Every construction project must organize new project management organizations. Once the project is completed, the corresponding project management department will be eliminated. When there is a new project, it must rebuild the organization and construction sites are always changing. Therefore, construction supply chain is instability. Also because of building design and construction of independence, construction supply chain is dispersive.

Building supply chain is also a typical supply chain which products according to the orders. The construction, existing and reconstruction of the supply chain are based on market demand.

II. Source of Risk Regarding the Construction Supply Chain

Analysis of External Environment Construction Supply Chain Risk

The risk from external environment in the construction supply chain mainly refers to the external factors such as natural environment, industrial policy, economic conditions and basic building situation in the processing of construction project.

Natural environment risk - the construction area is relatively largely constrained by the natural conditions. The unconventional destruction suffered from floods, fires, typhoons, earthquakes, etc. results in enormous loss to the construction industry.

Market risk mainly refers to the variation of market demand and the change of competition conditions during the economic cycle of the construction supply chain. The operation of the supply chain is market demand-oriented; all the sections in the supply chain, such as project planning, construction organization, materials procurement, equipment leasing, products selling, are based on the accurate prediction of market requirement and supply. The intensification of market competition greatly enhance the uncertainty of consumers' demand and preferences which make accurate forecasts more difficult and increase the operational risk throughout the supply chain.

The political and financial risks mainly include in the construction industry-related area, the variation of policies and regulations, the changes of social environment, the adjustment of market interest or exchange rate, financial policy changes, market inflation and so on. China is ongoing economic restructuring, so government policies may change along with the reform while such uncertainty of government policies will have a great impact on the enterprises' business.

Analysis of the Risk of Internal Environment Construction Supply Chain

The risk of internal environment construction supply chain mainly refers to various risks that may appear on each cycle from customers, contractors, subcontractors, suppliers to the end-users of this internal whole chain. It mainly includes management risk, technology risk, information risk and the risk of several types of systems. And every type of risks has some detailed risks, too.

Management Risk

The application of construction supply chain makes a more closely relationship among the members, therefore, the risks brought by lack of management control has greater impact to the entire supply chain members. Management risk mainly includes the following areas:

First is the construction quality risk. As the construction process involved in complex processes and each process also needed to closely coordinated, once there has a problem in the construction quality, it will likely lead to schedule delays, contract invalidation, materials backlogs and cost up and so on. It will cause discontinuity in the entire construction industry supply chain which will be able to bring the reducing of efficiency.

Building materials and equipment supply risk also exist. Materials supply risk cover: the risk of raw materials or semi-finished products selection, procurement and supplier selection. Construction work requires building materials in large quantities including concrete, steel, masonry, timber and other materials as well as various machinery and equipment, transport vehicles and other equipment. So materials supplying and equipment leasing are the key links. Because of some uncertain factor, not all of the suppliers can promise to supply the materials on time.

There also has management risk within the supply chain. The existing construction project use project management approach. Whether it can complete the project on time involves in co-ordination of the project leadership, project management systems implementation, contract management and so on. If the management is out of control, workers coordinated poorly or the system is not strictly implemented and so on, those events will give supply chain of the construction industry adverse effects.

The risk of survey and design changes exists in the supply chain. Construction work is the carrier of supply chain in construction, and the pre-construction surveys must be done before the construction. On one hand, the project is conducted based on the identified engineering geology and hydrogeology, as well as some survey information, etc., which contain a lot of uncertainty, that is, risk factors. For example, the on-site geological conditions differ significantly from the construction plans during the construction process. The fall and collapse of a large number of rocks will cause super-digging, super-filling volume and project delay. On the other hand, the quality of the survey and design may give risks to the contractor. For some "trilateral" projects, the owners often amend the design plan, which leads to repeated changes of the design and the construction organization has to do preparations for the changes.

Technical Risk

Technical risk refers to the risks which are caused by all kinds of technical reasons in the construction process. It includes the following aspects.

The harm of item design risk to construction industry supply chain is much greater than design change. It belongs to the technical risk of construction industry supply chain. For some design units lack of responsibility or reduce design cost, the design may be not perfect, inadequate or even a blunder. When the accident occurs, design units often blame construction organization with disqualification of construction as an excuse. Because of this, the project shuts down which leads to the supply chain thoroughly fracture.

Construction specification is the technical operation standards in the process of construction, so the risk of improper use of specification included in the technical risk category. Certain circumstances need to use special operating specifications, which is an important characteristic of the construction industry. If the construction or supervisory organization has used the improper standards in the operating process, it will affect the project quality, materials purchase and other links, which will give the construction supply chain risks.

It also includes construction technical risk. Construction technical is a high professional requirement process, and its content is very complex and diverse. Special projects (aloft work, underwater construction, mine pit operation, etc.), the success rate of application of new technologies, the construction subcontractor's technical qualification and so on will affect the whole construction project.

Information Risk

It mainly refers to the supply chain risk caused by the information transmission. The construction industry involves many aspects and its supply chain is relatively complex. When information is transmitted through the supply chain, every link in the supply chain attaches a system error to the information flow. Continuously enlarged errors lead to information distortion, and uncertainty ensues. To conclude, the information risk is mainly due to "bullwhip effect". There are many factors that affect the "bullwhip effect", including the level of information sharing, the situation of information technology application, the deviation in the information link, accessibility of information in advance, information sensitivity, and the supply chain members' demand forecasting.

System Risk

It refers to the supply chain own system structure risk, which mainly decided by the selection and cooperation of each supply chain member, including mutual trust between cooperation enterprises, the impact of some enterprise's negative behavior to other members, and supply chain life.

III. Risk Control of Construction Supply Chain

Build the Perfect Supply Chain Early-warning System

Supply chain risk early-warning management is such a management approach in which some scientific methods and means are used in advance to prevent the possible risks in the supply chain management. Take actions timely and exactly and send warning signals as soon as the signs of risk

appear, in order to maximize the control of adverse consequences occurring. The supply chain risk early-warning system can predict risk which helps decision-makers select well suitable emergency countermeasures, and makes emergency system in the state of alert. So when the risk occurs, it is possible to control risk with optimal emergency plan and the high speed. Thus it can effectively control the risk of supply chain, promptly cut off the risk source to reduce the scope of victims and minimize the harm of risk brings. In the supply chain operating process, it can take more effective monitoring, management and control of risk. Construction enterprise's supply chain should establish a set of risk early-warning system with a healthy structure, so as to realize the dynamic analysis of supply chain risk and monitoring. The enterprise should gradually establish a sense of crisis and a good early-warning mechanism and enhance the overall chain's anti-risk ability.

Perfect the Contracts and Legal Documents

Construction contract documents relate to a lot of contents, and often owners only give basic and conceptual requirements in the contract. Therefore, omissions of terms and inconsistencies of the contents in the contract occur sometimes on specific projects, but the contract requires the general contractor must take full responsibility to the accuracy of the information provided by their owner in the contract documents. Therefore, the contractor should organize business and technology experts to explore deficiencies in the tender documents during the bidding phase and require owners to provide a written clarification or consider the quote price. At the same time, the contractor should actively promote the use of engineering model contract, establish and perfect relevant laws and regulations to reduce supply chain risks arising from contracts and laws.

Establish Strategic Partnership in Construction Supply Chain

The key of supply chain management lies in the connectivity and co-operation of each node enterprises in supply chain and coordination in the aspects of design, production, and competitive strategies in enterprises. Strategic partnership in supply chain between enterprises emphasis on long-term and stable relationship, such as long-term contracts, systems, incentive and restriction mechanism ; Such relationship shares common values, understands each other's needs and goals and trusts each other and enjoys information together to achieve a win-win or all-win situation. The essence of such partnership is actually a multi-mission entrusted with the commission and agency of which each enterprise with its principal-agent is a multi-faceted and multi-direction. Agent enterprises must not only respond in terms of price but also make better response in terms of quality, delivery lead time and financial position. In order to achieve the ultimate goal of customer satisfaction, each node enterprises collaborate and implement optimized in the whole supply chain to complete all-win results and through the institutional arrangements and design to enforce benefit-sharing and risk-sharing. The core general contracting business in the construction supply chain should choose the most suitable suppliers, engineering and labor sub-contractor and through practice to establish long-term strategic cooperative partnership.

Optimize the Structure of Supply Chain & Strengthen the Performance Evaluation of Supply Chain

The risk of supply chain is large due to the irrational planning of supply chain, resulting in too much uncertainty factors. To reduce such risk, first of all, to establish a simple and efficient supply chain, that is to reduce the number of suppliers and establish a solid partnership with a small number of strong technical force and reputable enterprises. At the same time, we must avoid the supply of single channel so as to prevent the risk of "broken chain". This makes it easy for us to monitor and control the suppliers, reducing the uncertainties arising from complexity of the supply chain, never losing flexibility. The performance measurement and evaluation of supply chain management is a very important issue. We must develop a reasonable indicator of performance measurement and evaluation from a strategic height. Performance management and evaluation are extremely important for the supply chain of integrated construction, which can be provided as a reference for the development of measures in improving the performance of supply chain in construction enterprises, promoting the successful implementation of supply chain in integrated building enterprise. The key to the establishment of an optimized supply chain lies in the establishment of a performance evaluation system. This optimized supply chain must be a system that is able to make a reasonable assessment of the roles each partner. Each functional department plays in optimizing supply chain and furthermore, to allocate reasonably the benefits optimizing supply chain brings.

Achieve Information Standardization in the Construction Area

Application of information technology is the key to advance information sharing in the supply chain. Therefore, the construction industry to implement supply chain management should pay special attention to the use of information technology. It can significantly reduce project costs in the construction area through information standardization. However, in actual operation, supply chain management has practical problems, such as security, laws and regulations, consultation time, initiative constraints, and selective mechanism, etc. In view of such problems, it could accordingly put forward the supply chain protocols to regulate this management. Supply chain is composed of text agreement, network support and standard setting. Text agreement is based on the form of the text to regulate the operational procedures, rules, norms, rights and obligations

adding the enterprises, dispute mediation and accountability in the supply chain. Network support is the implement of text agreement, while standard setting is the support of text agreement. Supply-chain protocols ensure the security of enterprises by strict rules, define non-compliance to supplement the law; through programming the process of the establishment of the supply chain to reduce the formation time; through the settlement to adjust the benefits and burdens generated by optimizing; through maintaining a certain openness externally and using of futures orders internally to increase business initiative. At the same time, supply-chain protocols provides a platform for implementation of supply chain performance evaluation and incentives and provides fundamental basis for the establishment of incentives objectives and the determination of the supply chain performance evaluation and incentives measurement.

IV. Conclusion

Supply chain management can improve the operation efficiency of the enterprise, but inevitably it brings risk to the enterprise in the supply chain. Every enterprise should have risk consciousness and strengthen supply chain risk management to improve the stability and reliability. Enterprises should undertake risk management system, adjust supply chain strategies, establish a risk management process, develop risk assessment methods and tools, formulate plans, and strengthen daily monitoring. It is important that construction supply chain risk management is not a single enterprise's responsibility, but relies on each enterprise's mutual support and cooperation.

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