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SUPPLY CHAIN MANAGEMENT IN CONSTRUCTION

SCOPE, BENEFITS AND BARRIERS

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SUPPLY chain management (SCM) is a concept that has originated in the manufacturing industry to control logistics. It represents a management process by which enterprises administer and control the worldwide network of suppliers, factories, warehouses, distribution centers and retailers through which raw materials are acquired, transformed and delivered to customers. In construction, procurement and procurement related activities occur during all phases of a construction project. Because of inevitable complexity and fragmentation of the construction process, supplies of resources like equipment, labor, material and other services may not be always available on time, in right amounts and in the desired quality and price. An overall management process like supply chain management is essential to monitor and control all such logistic activities.

The concept of supply chain management in construction outlining its origins in manufacturing is introduced in this paper. The effectiveness of the supply chain management has been evaluated with its potential benefits to the construction industry. A list of possible barriers, which may affect the application of supply chain management concept in the construction industry, has also been presented. Finally, a simplified model for supply chain management in the construction industry is presented.

Supply Chain Management (SCM): Concept

Supply chain management (SCM) is a well-established concept within the manufacturing industry although the terminology has changed over the years (McCaffer and Root, 2000). Ganeshan and Harrison (1995) defined supply chain as a network of facilities and distribution options that performs the functions of procurement of materials, transformation of these materials into intermediate and finished products, and the distribution of these finished products to the customers. Supply chains exist in both service and manufacturing organizations, although the complexity of the chain may vary greatly from industry to industry and firm to firm.

In Figure 1, an example of a very simple supply chain for a single product is shown. In this case, raw material is procured from vendors, transformed into finished goods in a single step, and then transported to distribution centers, and ultimately to customers. However, the realistic supply chains have multiple end products with

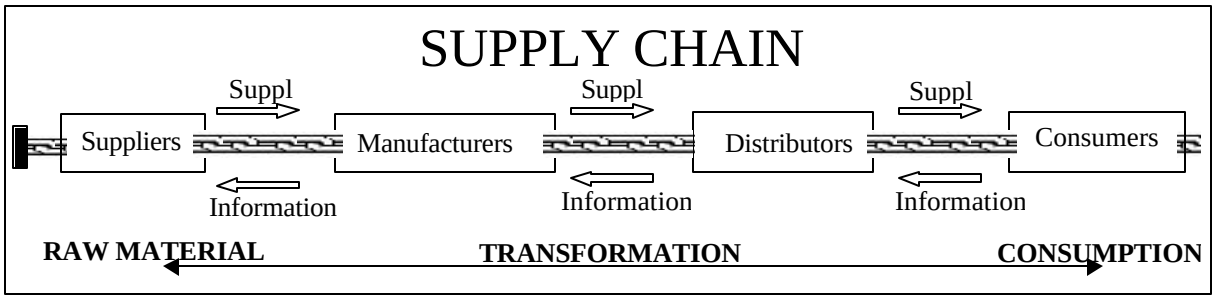

Figure 1: Supply Chain Visualization

shared components, facilities and capacities. SCM looks across the entire supply chain, rather than just at the next entity or level, and aims to increase transparency and alignment of the supply chain's coordination and configuration, regardless of functional or corporate boundaries (Cooper and Ellram, 1993).

Traditionally, marketing, distribution, planning, manufacturing, and the purchasing organizations along the supply chain operate independently. These organizations have their own objectives and that are often conflicting. This traditional way of managing is essentially based on a conversion (or transformation) view on production, whereas SCM is based on a flow view of production. The conversion view suggests that each stage of production is controlled independently, whereas, the flow view focuses on the control of the total flow of production (Koskela, 1992). Table 1 presents a comparison between traditional management and the SCM in the production process.

Table 1: Characteristic differences between Traditional Ways of Managing the Supply Chain and SCM

Element	***Traditional Management***	***Supply Chain Management***
Inventory management approach	Independent efforts	Joint reduction of channel inventories
Total cost approach	Minimize firm-costs	Channel-wide cost efficiencies
Time horizon	Short term	Long term
Amount of information sharing and monitoring	Limited to needs of current transaction	As required for planning and monitoring processes
Amount of coordination of multiple levels in the channel	Single contact for the transaction between channel pairs	Multiple contacts between levels in firms and levels of channel
Joint planning	Transaction-based	Ongoing
Breadth of supplier base	Large to increase competition and spread risks	Small to increase coordination
Amount of sharing risks and rewards	Each on its own	Risks and rewards shared over the long term

Source: *Cooper and Ellram, 1993.*

Many manufacturing operations are designed to maximize throughput and to lower costs with little consideration for the impact on inventory levels and distribution capabilities. Purchasing contracts are often negotiated with very little information beyond historical buying patterns. The result of these factors is that there is no single, integrated plan for the organization – there are as many plans as businesses. Clearly, there is a need for a mechanism through which these different functions can be integrated together. SCM is a strategy through which such integration can be achieved.

Generically, the methodology of SCM consists of four main elements: (1) supply chain assessment; (2) supply chain redesign; (3) supply chain control; and (4) continuous supply chain improvement (Vrijhoef and Koskela, 1999) as shown in Figure 2. This figure explains that the first step in SCM is to assess the current process across the supply chain in order to detect the problems and find their root causes. Once the root causes are detected, the next step is to redesign the supply chain in order to introduce structural resolution of the problems. This includes redistribution of roles, tasks and responsibilities among the actors in the supply chain, and a review of procedures.

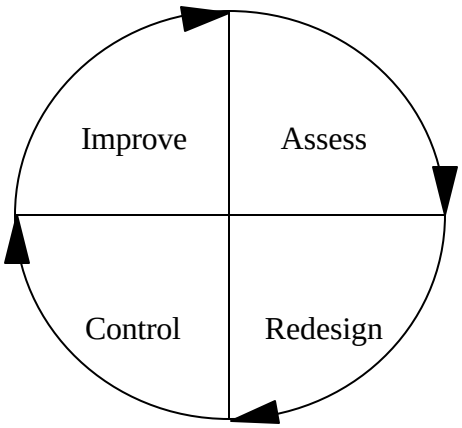

Figure 2: Generic Supply Chain Management Methodology

Source: *Vrijhoes and Koskela, 1999.*

The third step is to control the supply chain according to its new configuration. An important part of the control function is the installation of a monitoring mechanism to continuously assess how the supply chain operates. The next step involves the introduction of feedback systems to discuss and evaluate underlying problems. The main objective of this step is to continuously identify new opportunities, and find new initiatives to develop the supply chain. In fact, this continuous improvement implies the ongoing evaluation of the supply chain process, and the recurring deployment of the previous three steps: assessment, redesign and control.

The above methodology is developed for the manufacturing industry but could also be applied to the construction industry, as purchasing and logistic operations are same in both industries. Proper time management of purchasing function may save money, which would benefit the entire organization. This paper will discuss the opportunities of SCM in the construction industry with possible benefits and underlying barriers.

Supply Chain Management (SCM) in Construction

Although engineers, construction managers and contractors do not typically consider the supply chain or SCM, they deal with the supply chain and make SCM decisions on a daily basis. In construction, supply chain refers to the end-to-end "chain" of stakeholders and partners that come together both on individual projects and during a firm's business life. In a project, a supply chain includes the owner, planner, designer, architect, engineer, construction manager, general contractor, subcontractors, suppliers, distributors, and manufacturers. Throughout a firm's business life, components of a supply chain may also include accounting, human resources, equipment fleet operations, etc.

Within the construction project, the supply chain can be simply conceived with the owner at the top followed by designer, contractor, specialist contractors/subcontractors/suppliers etc., forming various levels of supply chain. Demand can be seen as flowing down the chain in terms of information, e.g. project briefs, drawings, schedules, works orders etc, with a flow of goods and materials flowing in the opposite direction (McCaffer and Root 2000).

However, the management of this supply chain is often problematic due to the fragmentation in the construction industry; increasing complexity of the projects and the demand for greater performance at lower costs from the clients. These problems have led the stakeholders to become more actively involved in the project life cycle. This drive is illustrated in the complexity/strategy matrix in Figure 3. The matrix proposes a more active and collaborative involvement of the stakeholders as the project complexity and strategic importance increases. This will shift the construction industry towards more collaborative approach characterized by the development of 'fewer but deeper' business relationships.

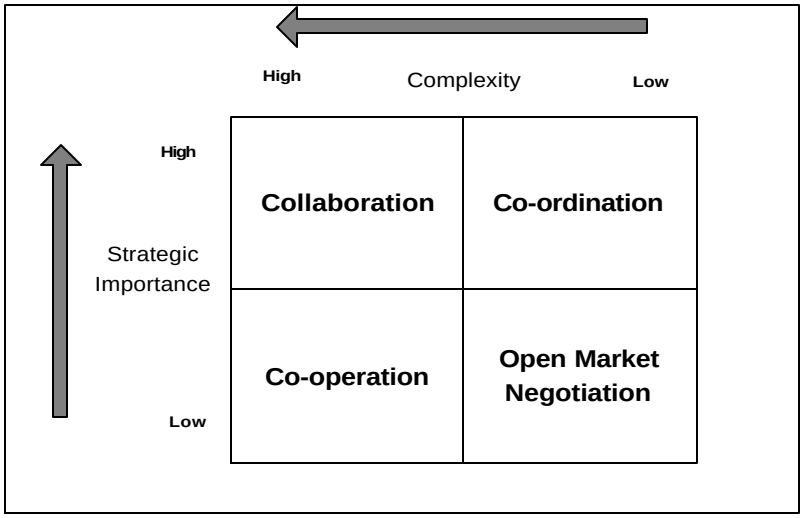

Figure 3: Complexity Strategy Matrix

Source: *McCaffer and Root, 2000.*

The authors have proposed a simplified model for the application of supply chain management concept in construction, which is shown in Figure 4. This model divides the construction process into two major processes,

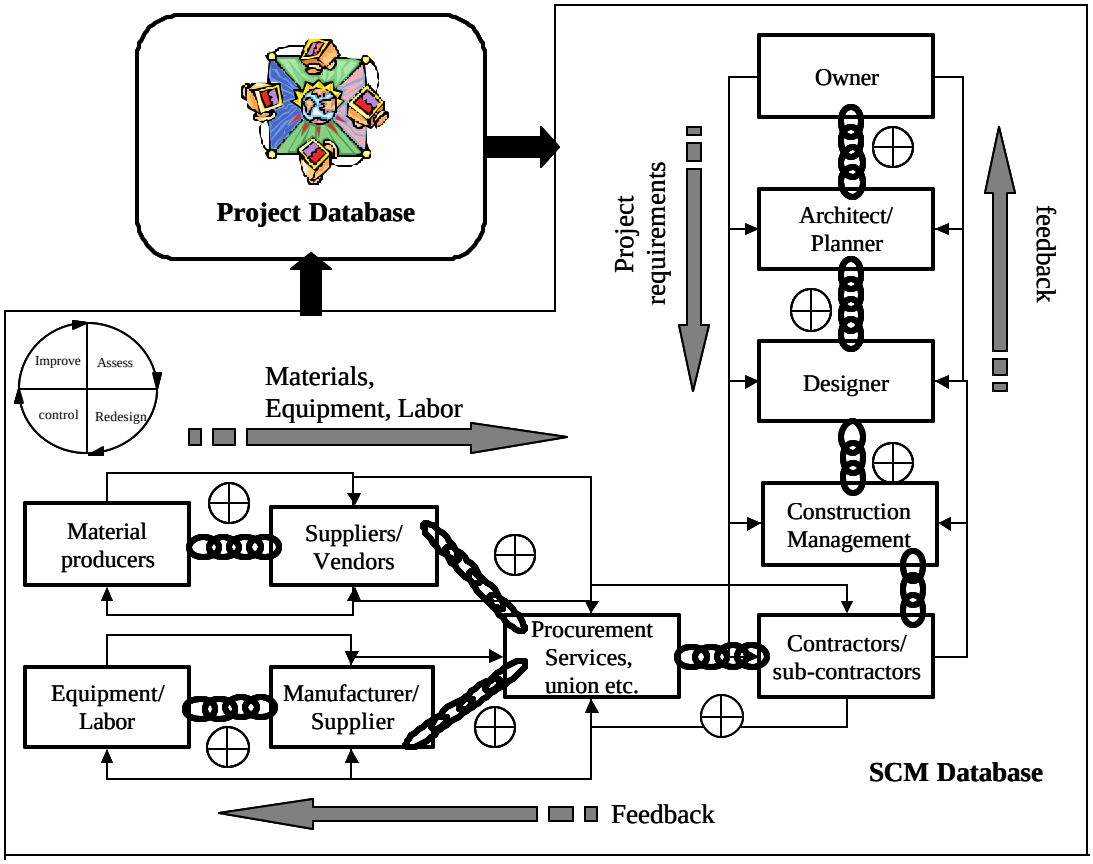

Figure 4: A Simplified Supply Chain Management Model for the Construction Industry

(i) the procurement process and (ii) the construction services process. The procurement process deals with the supply of materials, equipment and labor to the construction site. The stakeholders in this process are the material producers, equipment manufacturers, the wholesalers, suppliers or vendors, labor unions, the contractors and the subcontractors. The chain in this process can be termed as 'procurement chain' .The construction services process essentially consists of clients, architects, designers, construction manager, contractors and the sub-contractors and the so formed chain can be named as construction chain. The project requirements move across the construction chain in the form of project briefs, schedule and budget as explained earlier. The model proposes that all the supply chain activities are managed through a separate SCM database, which should be linked with the central project database. Only with this level of support, one can plan and control the complexity of construction processes and projects.

Promising Benefits of Supply Chain Management in Construction

Walker and Alber (1999) highlighted that business organizations always want to reduce the product development time, improve the product quality and reduce production costs and lead times. Different concepts of business process reengineering, scheduling, materials management, and total quality management (TQM) have been used to attain this target, but success, at best, has so far been partial. Supply chain management because of its holistic nature has the potential to address such challenges and issues. This fact has been realized by a lot of organizations that recognized with time the fact that the ongoing competitiveness of an organization is tied to the dynamics of the supply chain(s). This recognition is leading to a considerable change in the way organizations interact with their supply chain partners, thereby resulting in better information communication and co-ordination. Another benefit may be felt in low transaction costs as has been observed by Stanford et al. (1999). He pointed out that an efficiently organized supply chain could result in low transaction costs and highly competitive industry in global markets because of internalizing the transactions between the trading partners in the chain through cooperation and coordination.

Supply chain management looks at the enterprise as a whole. It includes not only relationships with other functions within the firm but also with all trading partner relationships outside the firm. For this reason Supply Chain Management is said to have 'Visibility' and allows development of a consistent supply and demand plan from the customer to the supplier. Hence a planner, by taking a holistic view of the process from start to finish, can devise a complete plan for the movement through the chain of a specific product. This kind of planning could take place between the various functional groups (sales/marketing, manufacturing, distribution) of a vertically integrated enterprise or between several independent companies in the distribution channel (raw material suppliers, manufacturers, third party logistics services). This can provide better service, reduce inventories, reduce paperwork, help consolidate distribution centers, and reduce transportation costs. True SCM exists only when all parties benefit (Turner, 1993).

Barriers in the Implementation of Supply Chain Management in Construction

The authors have concluded the following reasons for the slow growth of supply chain management in construction.

- Lack of guidance for creating alliances with supply chain partners
- Failure to develop measures for monitoring alliances
- Inability to broaden the supply chain vision beyond the procurement or product distribution to encompass larger business processes
- Inability to integrate the company's internal procedures
- Lack of trust inside and outside a company
- Organizational resistance to the concept
- Lack of integrated information systems and electronic commerce linking firms
- Lack of suitable organizational setup

In addition, Fox et al. (1993) figured out the problems at operational level and have described various factors like bank rates, political situation, material delivery, labor strikes, site accidents, design changes, etc., which makes it difficult for a chain to work efficiently.

Conclusions

Supply chain management (SCM) is a great opportunity for the construction industry primarily to reduce cost and time, and thus improve profitability. SCM principles seem to have much strength to smoothen and integrate the construction processes. The supply chains in construction could be divided into two major groups as materials chain and the construction chain, which would help to separate the procurement and management operations. However, both chains are linked through a SCM database, which is further linked with the central project database. This would ensure the smooth flow of information within the different chains and results in increased collaboration within the supply chain partners. Obstacles for supply chain management are found to be poor level of logistical competence, lack of guidance for creating strategic alliances, inability to integrate the company's internal procedures, strong project focus as well as the attitudes and traditions in the construction industry.

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