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Application Opportunities of SCM Tools to the Construction Industry
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Application Opportunities of SCM Tools to the Construction Industry

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Summary: This thesis analyzes the relationship between SCM practices and their use in the construction industry. For this, the research looked at the industry as a whole, in different parts of the world but focused on information and firms in the United States and Europe. It further focuses on the construction firm echelon both through academic and industry journals, as well as through the perspective of firms' leaders. Size demonstrated to be a key indicator in identifying which firms are better able to take advantage of SCM tools and practices.



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KEY INSIGHTS

1. Larger firms have been and will continue to use SCM systems to optimize their performance, having the financial resources necessary to apply these tools.
2. Conversely, smaller firms have limited resources and accessibility to SCM applications.
3. Any industry-wide performance impact derived from the use of SCM theories will be affected by the size and resources of the firm.

Introduction

The global recession of 2008, which actually had begun in 2007, was responsible for bursting the "construction bubble" that was present in many countries. This industry is closely tied to national economies, so it is important to the worldwide economy. Generally, despite a drop of 3.6% in 2010, this industry still is valued at well over \$2,276 billion and current forecasts predict that by 2015, the industry value will increase approximately 32%, which will put the value close to \$3,005 billion (Castro, Galán, & Casanueva, 2009). Both the US

and Europe saw significant drops in the industry between 2009 and 2011. More specifically, countries like Spain, where construction is an important element that promotes their national economy, this recession has been particularly difficult. In 2007, the Spanish construction sector accounted for 17.8% of the GDP and employed 12.7% of the total workforce of its market. Spain saw a construction output decline of approximately 43.7% by 2011 (Castro, Galán, & Casanueva, 2009). In the US, jobs were reduced to levels that had not been seen since 1998. Construction companies saw their funding frozen, while their projects were in mid-construction; forcing them to change the way they managed their business and to find alternative sources of funding to be less dependent on external financial institutions or governments.

The construction industry is characterized by complex projects and the large number and types of roles that interact and require coordination in order to carry out a particular project. Supply chain management, still searches for new areas where its theories may be applied. The literature available has uncovered little or no specific analysis of the construction industry from the perspective of supply chain management. A thorough understanding of the

industry is first necessary to identify the main problems it faces. Moreover, it is necessary to understand how these problems are currently being addressed by different players within the industry. With that information, potential solutions using SCM tools, skills, and methodologies that have not been previously utilized may be identified.

The research analyzes the potential benefits of the application of SC Management tools and problem-solving skills to industry-specific problems. In order to deliver a complete analysis, the research must first understand the industry as a whole, its power structure, value chain, and especially focus on the role of the construction firm within that chain. It must also identify which SCM tools are currently being used and whether more of these tools could be used. It is important to note that a firm-by-firm or a sector-by-sector analysis of the industry is not necessary, since it would not result in additional information that can be applied to the industry as a whole.

Methodology

Positivist empirical research is based on the existence of *a priori* theories which are then confronted with practical results to define if these results were expected according to theory (Yin, 2003). This confrontation gives rise to the iteration process between theorizing and confirmation, resulting in improved theories. Improvement could come by increasing the level of exactness or by clarifying the boundaries of applicability of the theory under study.

The literature review on the construction industry, the construction firms that operate within the industry, and the role of SCM tools being used; has been used to generate an initial theory (the hypothesis presented). Using the positivist empirical theory process, the data collected was analyzed and confronted with the theory presented, therefore improving the theory while also developing clearer boundaries of applicability of this theory.

Data collection was done using interviews to industry participants were used. One of the objectives of the interviews has been to include the current conditions, especially the changes that have come about as a result of the worldwide financial crisis. Interview methodology allows for the closest connection to and strongest feedback with the individuals who are immersed in the challenges and developments of the industry. To take advantage of the process, follow up questions were used during the interview. The interviews contained questions focused on

understanding the internal conditions of the industry and of the firms and its obstacles. Additionally, anecdotal information on the company and on the practical experience of the interviewee was gathered. Based on the answers, the interviewer is able to gauge the interviewee's understanding of SCM, its tools, and their application.

Interview Highlights

At an industry level, the two greatest risks for 2011 are economic downturn and increased competition. Interviewees in different parts of the world confirmed the industry report, since the biggest problem was the significant reduction of available projects and the presence of new competition. This reduction in jobs also has repercussions on the general economy because job growth in the industry is stagnant (Horvat, 2012).

The main issues that affect the industry vary somewhat according to region. The US construction industry faces materials procurement, labor, and technology use issues. Materials procurement is done globally, while labor is completely locally sourced. Technology requires a cost vs. value analysis (Horvat, 2012). In the Spanish market, labor issues are related to having the properly trained personnel for each specific task at the time the task is programmed to be done.

Large firms in Spain are focusing more on the trend of small and medium firms to enter into temporary joint ventures (Valderas, 2011). This issue is present in other parts of the world and has sparked literature analysis on its benefits and pitfalls. While one of the interviewees suggests that small firms should make Case experience in other countries, like the US, suggest that finding niche markets and roles is the best way for small firms to compete and survive even despite the current economic situation. The size of the firm defines the type of risk it will face: large firms are more vulnerable to price-cost escalation, while small firms face little or no hedging capacity (Horvat, 2012). Research done on the benefits of relations between firms working in the joint projects concluded that trust is a key ingredient in the successful completion of the projects. The research tends to support the view that alliances should be viewed long term, and not project specific.

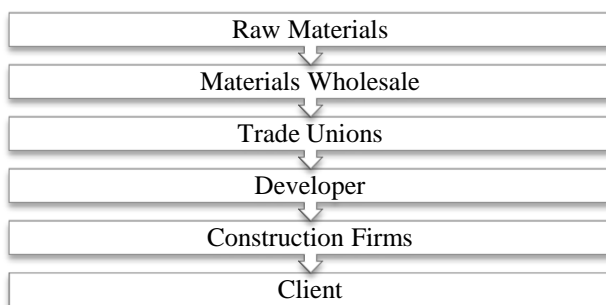
Interviewees suggest that the two most important strategies to face some of the existing problems are diversification and exploring other markets (Valderas, 2011). Some of the ideas suggested in the interview as well as in the literature, include green tendencies,

energy, outsourcing, or getting involved in different types of projects. With regards to expansion, there are specific cases of large firms from developed nations involved in projects in emerging or developing economies. In the case of firms that have opted to go for the “green” standards or practices, there is still much work to do with government agencies to have a complete definition of what these standards and practices are. LEED standards are the most recognized, but certainly not the only ones in the market (Freeman, 2012).

Banks are now more limited by regulations in their efforts to finance projects. Larger firms still leave financing responsibilities to their clients, which makes them more flexible to participate in a larger number of projects. On the other hand, given the current global economic scenario, this approach could result in a reduction of the client pool. By contrast, this financing limitation has forced smaller firms to enter into what has been denominated as “public-private partnerships” or PPP, where public and private entities with limited funding capacity have joined financial resources for new projects.

From the data collected, a detailed value chain is presented, below.

Figure 1
Detailed Construction Value Chain



An important characteristic of this value chain is that it separates the raw materials supplier (source) from the materials wholesaler. This reflects the industry reality that some materials are generic, while others are very specific. A second key characteristic is that this chain separates the developer from the construction firm as distinct functions, though in practice some of the larger firms offer designing services with the construction company services, creating a “whole project management” packaged service.

When discussing SCM practices, the interviewees consider that the practices used vary significantly depending on the size of the firm: larger firms are

more sophisticated in their understanding and use of SCM practices, as well as enjoy the financial capability to manage inventory. Small firms are conditioned by their financial limitations. Even if they know inventory and risk management practices, it is financially unviable for them to fully apply these practices.

Opportunities

The information gathered thus far demonstrates current, though not widespread, use of SCM tools. A more extensive application of these theories can help provide insight of how best to face the future, with all the risks, uncertainties, and changes that will come with it. This research identified some of the most important applications.

Supply chain network and strategy: Given the changes in the project pool in the industry, small and medium size firms have favored project-specific joint ventures, while larger firms have tended towards vertical alliances and mergers. All these unions affect the flow of materials and the allocation of the different functions of projects. From a strategic perspective, the way competing firms interact with each other requires defining the roles of the partners in the union to assure an organized supply chain that will function profitably for all participants. Issues like the continuation of a joint venture in time, the role of small firms in niche markets, and how large firms expand beyond their current borders of operations are strategy issues that need to be addressed.

Newsvendor model: Uncertainty of demand, of materials supply, of final project conditions/costs, and of labor requirements are just some of the many variables that construction firms must face. The newsvendor model application can provide insights to negotiate better prices with suppliers, as well as in making decision for their bid/budget.

Demand forecasting: Finances are stretched in construction firms. Understanding their pipeline and what can affect it is critical to the sustainability of any firm. Until recently, firms have relied on historical cyclical information for their specific niche and geographic location. Demand forecasting is an important tool to help understand the additional elements that can affect demand, *i.e.* the project pipeline continuum.

Inventory management: Understanding materials inventory, its warehousing requirements – maintenance, environment, safety –and the timeline of when each type and quantity will become necessary during a project can affect a firm’s

performance, both in its on-time project delivery and its profit margins. Some materials can be considered commodities or commodity-like, as are concrete or nails. Other materials are high-value, such as marble, specialized woods, technological equipment and require more care in their planning, management, and usage. Inventory tools and technology improve tracking capacity and redefines purchasing policies.

SC Coordination: Construction sites generally do not have a large warehouse capacity, so lack of coordination in delivery of these materials could result in expensive warehousing costs, deterioration, or even loss due to petty theft.

At a macro level, strategic decisions like participation in a temporary joint venture or making a vertical integration could also benefit from a coordination analysis. The analysis could shed light on optimum performance of the new entity and how to make the changes needed to meet the improved performance expectations. Long term applications of managerial incentives and good coordination practices across all echelons of the supply chain generate financial stability for all participants into the future.

Game Theory: The bidding process is generally used for public and private projects. Participants bid based on the incomplete information supplied. Bid quotes of other participants are undisclosed at the time of the bid, with only the winning bid being disclosed. Participants will likely compete again in the future. All bids are presented at the same time. Game theory takes into account all these variables and can analyze a bidding quote as a one-time, winner-take-all scenario (stochastic) or a recurring model in which the actions that a firm took in a past bid will be taken into consideration by the other firms in future bids.

Game theory can also be used when negotiating a temporary joint venture and/or future permanent mergers. This discipline analyzes the strengths of each firm and provides insight on how to manage the negotiation process, regardless of any size or function-based bias prevalent in the industry.

Contracts Coordination: Construction projects are very complex, requiring a large number of firms to participate in their completion. Construction firms are ultimately responsible for the completed projects, so they must coordinate all participants, controlling costs while at the same time making sure that every participant receives their profit share. Contracts used to coordinate suppliers help assure performance,

thereby benefiting the whole chain and avoiding unforeseen and unnecessary costs and penalties. Contract coordination is a preventive treatment that defines, among other things, who assumes the responsibilities –and the costs- in an event of breach. This tool can also be useful in joint ventures negotiations, because coordination tools can define performance standards amongst participating firms.

Conclusions

The focus of this research is whether SCM tools can improve the performance of firms in the construction industry. The answer to that question depends on the size of the firm.

Large firms have a strong and sophisticated system that includes SCM and its tools already in place. The widespread use of these tools is evidenced in how they generally conduct business, from supplier coordination to warehousing practices. The current tools used in large firms reflect how the knowledge of individuals has permeated the firm. From a financial perspective, large firms have the financial flexibility, warehousing space, and even the personnel to apply these theories. Their worldwide operations provide pricing protection, negotiation power with their suppliers, and hedging capabilities against other operational and financial risks. Thus, large firm performance improvement due to SCM practices is limited.

Small firms are financially constrained to take advantage of the SCM tools and practices. Small firms have limited resources for inventory management, less negotiating power with suppliers, and are less capable to hedge against pricing fluctuations in the market because their operations are usually local. Inventory management, game theory, and the newsvendor model are three of the most important SCM practices that can help small firms.

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