



Supply Chain Management in the Construction Industry

E-business & Fourth Party Logistics

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Abstract

The construction industry is a very fragmented and diversified sector due to the uniqueness of the final products, the variability of the production environment, geographical location, and construction methods. It is also a sector marked by the high dependency of labor techniques, directly associated with the economic, social and political conditions of the regions where it operates. Given this complex and sometimes adverse reality, the construction industry often presents itself as a peculiar case study, with several challenges to the implementation of change management based on the adoption and integration of information systems and technologies.

On the other hand, the movement of the market and society towards the adoption of new technologies and information systems has been remarkable, and as a result we have seen the transition from a traditional management context, based on functional silos, to a supply chain management context, based on the compatibility and coordination of processes and stakeholders.

This dissertation intends, in a first instance, to understand the characteristics and elements setting the concept and practices of supply chain management, in order to transpose these characteristics and elements to the construction industry, within the scope of construction projects. And in a second instance to interpret the framework of supply chain suppliers or fourth party logistics (4PL) and their activity within this scope, proposing possible solutions to support the integrated management of the supply chain in construction companies, based on information systems and technologies.

Keywords: Integrated Supply Chain Management; Construction Industry; Enterprise Construction; E-business; Supply Chain Management Outsourcing; Fourth Party Logistics (4PL).

1. Scope of the Thesis

The construction industry is a very fragmented and diversified sector due to the uniqueness of the final products, the variability of the production environment, geographical location and construction methods. It is also a sector marked by the high dependency on labor techniques, directly associated with the economic, social and political conditions of the regions where it operates, and has a vast impact on other industries and sectors – *Figure 1*. At the same time, unlike other industries, there is no serial production line in construction, but rather a one-off event, with unique and heterogeneous characteristics, in terms of production environment, final product and implemented techniques to execute it.

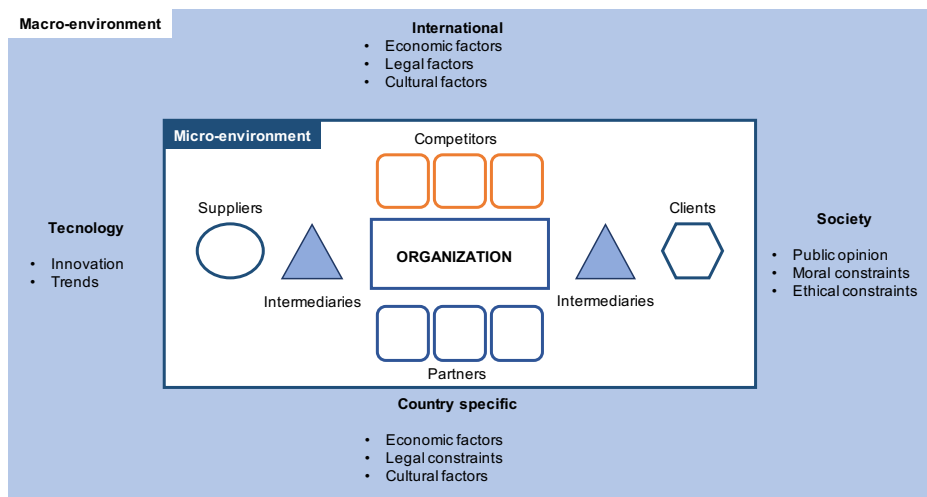


Figure 1 - Map of a business environment inherent to a service or product exchange, source: Chaffey (2011)

Given this complex and sometimes adverse reality, the construction industry often presents itself as a peculiar case study with several challenges for the adoption of a successful change management, based on the endorsement and integration of information systems and technologies. At the same time, the lack of willingness of construction companies to invest the capital and time needed to transform their activity, corporate values, management methods, and relationship models with other entities, has been a barrier to the development of an integrated value chain in order to optimize the flow of goods and services inherent to the construction product.

Although there is some variability, depending on the size of the company and the works concerned, there is a set of technologies that have been adopted to improve corporate management processes and their modes of operation, such as, e-marketplaces, Enterprise Resource Planning Systems (ERP), planning tools, project management systems, and more recently the Building Information Model or BIM. Nevertheless, the movement towards integration of business processes between companies and within construction companies has been relatively slow. It should be noted that, on one hand companies need to have their business structures and operations properly established and organized and, on the other hand there must be a common "language" between organizations, based on a trusting partnership and sharing of interests and strategies.

Compared with other manufacturing industries, the construction industry is made up of temporary organizations that provide temporary fragmented supply chains, causing adverse relations between these actors. As a result, partnership management and communication management (both composing relationship management) have been seen as a way to overcome the temporary nature of construction and to introduce greater comfort, efficiency and effectiveness within the sector. At the root of the growing importance of the relationship and rapprochement between stakeholders is the need to ensure that the flow of goods and services between these organizations is managed in the best possible way, and therefore, that the supply chain and the multiple "stages" by which a product may have passed to arrive from point of origin "A" to the final destination point "B", are taken care of in order to assure the

sustainability, value, and both strategic and operational frameworks of the processes and activities involved.

As a result, from the supply chain management supplier's perspective or fourth party logistics (4PL), the materialization of such services shall not be accomplished only through strategic support of companies, but also through the development of products based on information systems and technologies, such as the creation of data warehouses and operating systems capable of establishing multiple connections between supply networks and managing them from a single control point. There are several companies that have come to play an important role in the transformation of organizations in favor of adopting an integrated management philosophy based on the supply chain, however the true materialization of the concept of integrated supply chain management and outsourcing of the supply chain management as a service and opened solution, hasn't been yet fully accomplished.

While the concept and practices of supply chain management begun gaining prominence in result of the need of bringing together and matching the business structure and processes of organizations, while adopting an international or digital strategy, third party logistics services suppliers (3PL) which tended to cater for the logistics needs of companies (mainly focused on outsourcing the implementation or execution of functions such as transport, distribution, storage and inventory control) started evolving their services towards the satisfaction of its customers, by performing some value-added services resulting from the needs of specific parts of each supply chain – *Figure 2*.

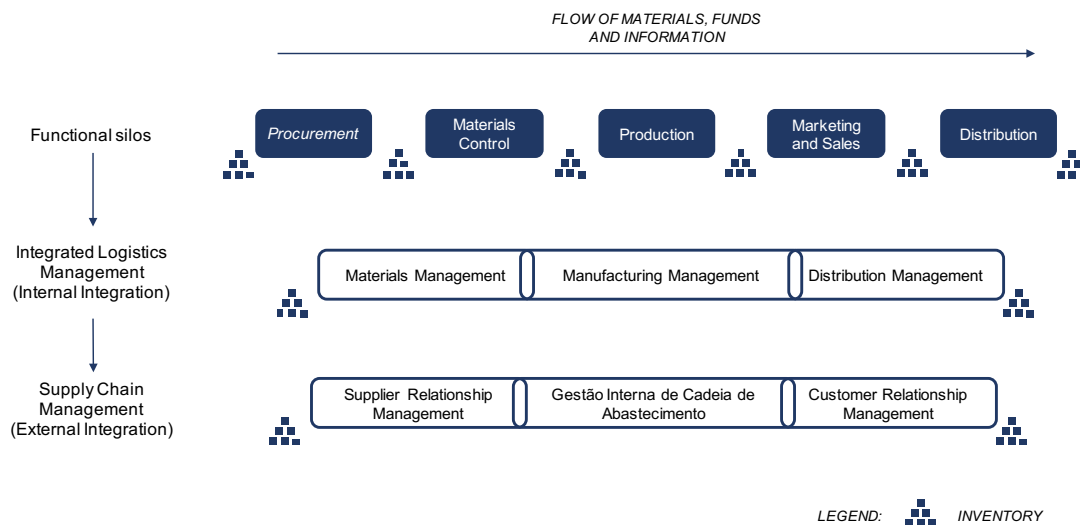


Figure 2 - Logistics evolution: From distribution logistics to supply chain, adapted from Rushton et al. (2010)

As a result of the evolution of logistics services and simultaneous integration of logistics systems in the supply chain, the fourth logistics concept (4PL), also known as the Lead Logistics Provider (LLP), has emerged – *Figure 3*.

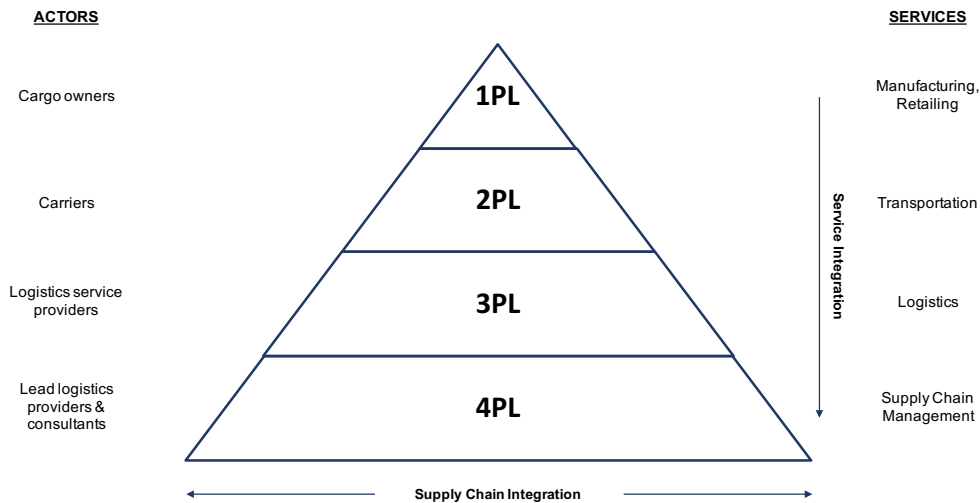


Figure 3 - Party logistics concept evolution, source: Blog (2014)

The 4PL is therefore an entity specialized in integrated supply chain management, that enables the realization or outsourcing of key elements of the supply chain to more specialized third parties, while assuming joint management of those strategic and operational systems (total outsourcing) – Figure 4.

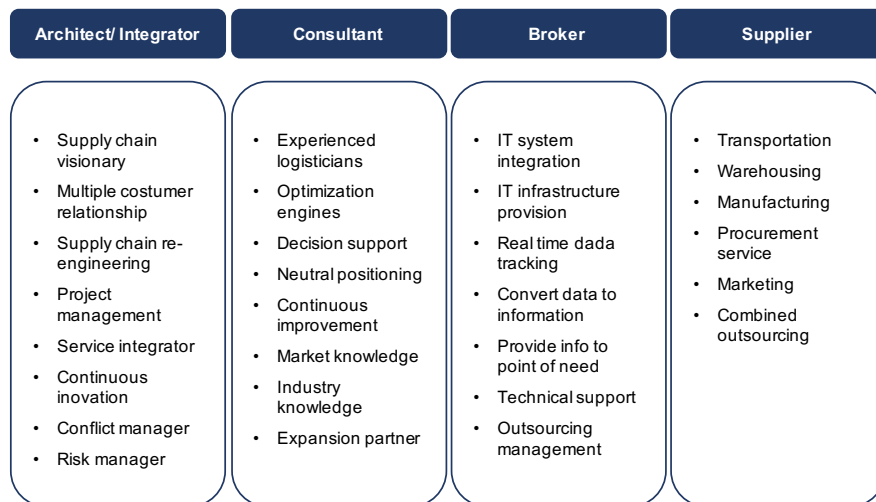


Figure 4 - Fourth-party logistics (4PL), showing the main areas of service that could be provided, adapted from Rushton et al. (2010)

2. Research Goals

This dissertation intends, in first instance, to understand the characteristics and elements that make up the concept and practices of supply chain management, in order to transpose these characteristics and elements to the construction industry, within the scope of construction projects. And secondly, to interpret the framework of the activity of these suppliers of the supply chain (4PL), proposing possible solutions, based on systems and information technologies, to support the integrated management of the supply chain of construction companies.

3. Research Methodology

With the stated goals in mind, the research was based on the following key points:

- Understand the concept of supply chain management and define its main elements;
- Define the "stages" and main actors associated with the product life cycle of the construction product;
- Define the theme of supply chain management within the construction sector and site management;
- Analyze and propose possible 4PL solutions and services to support the organizational and cultural transformation of construction companies.

Given that supply chain management implies a large number of organizations, processes, activities and concepts in order to be defined in a more precise and realistic way, it was a necessary condition for the study to be driven into an approach focused on construction companies. While addressing exclusively the contractor's intervention represents a bridging of the study on the integrated management of the supply chain of the construction industry, it serves the purpose of creating bases towards the study of the framework of 4PL suppliers in the construction sector.

Since the study implied in accomplishing the objectives of this dissertation requires a gradual focus of the general themes highlighted and a structured approach, in order to ascertain specific aspects within the construction sector and companies that operate in it, it was considered important to adopt an approach favoring the constitution of a general model that allows, on one hand, an organized view over the theme and scope of supply chain management, and on the other, that can be applied across different entities, sectors or segments of supply chain management.

As a consequence, the model adopted to describe the scope of supply chain management has been defined by 3 key elements: structure, management processes, and supply chain management components – *Figure 5*.

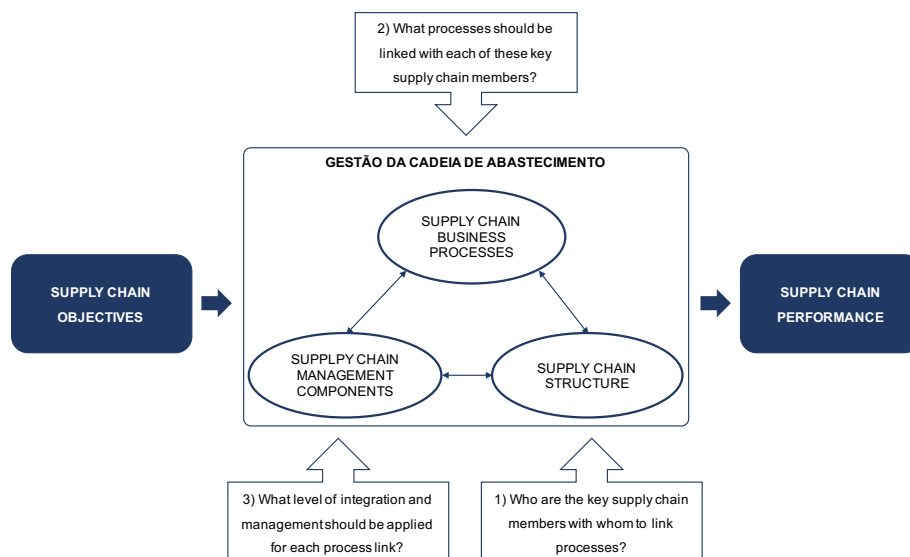


Figure 5 - Supply chain management key elements, source: Vorst & G.A.J (2004)

In order to standardize the functions of supply chain management, and consequently the business functions of the 4PL, the structure of the companies and scope of their activity was revised, taking into

account 5 macro-processes or structuring topics that are applicable to any company or business activity: procurement, logistics, including physical distribution logistics and production logistics, marketing, and corporate management - *Figure 6*.

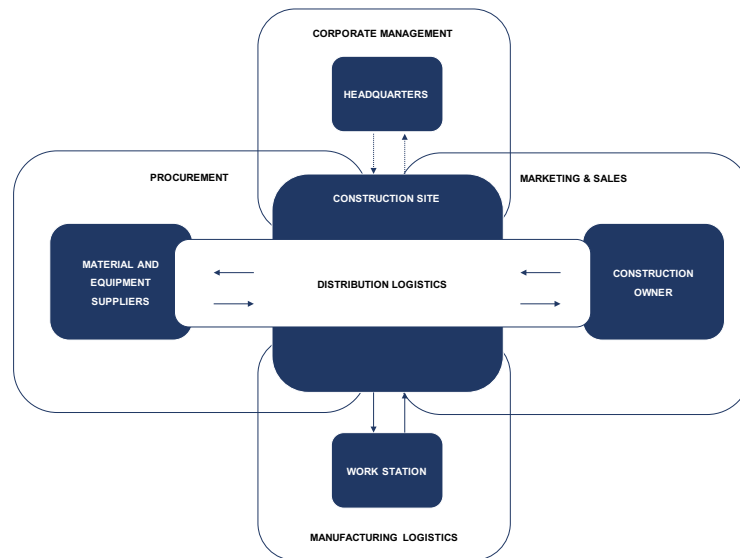


Figure 6 - Direct supply chain and its macro-processes

Each macro-process is reviewed from a conceptual and electronic implementation point of view, and the main activities or areas of knowledge that integrate the groups of processes of planning, execution and control that integrate the site management, are defined.

4. Results and discussion

The present dissertation concludes that supply chain management is a vast and complex subject that can be defined from the point of view of the transacted product or service, as well as from the point of view of the company, taking into account the multiple products and services that these carry out for their activity. At the same time, supply chain management is an emerging issue that results both from the needs that arise from the global market reality at an international level and from the need to transform the values of organizations, the way they lead their activity and their relationship model with other entities.

With the transition from a traditional management context, based on functional silos, to a supply chain management context, based on the compatibility and coordination of processes and stakeholders, the importance of the role of solution and services providers has been stated as a mean to ensure success in implementing change management, in favor of integrating the supply chain and its stakeholders.

In conclusion, it is assumed that 4PL is the strategic partner for the outsourcing of any specific function of supply chain management, and plays the role of architect/integrator, mediator, consultant and supplier of solutions and services in this scope, assuring equality of circumstances, balance of benefits, cooperation and quality assurance of relationships and communications between organizations and within organizations. Whereas its activity is limited to the strategic support of the internal business processes of its clients, in order to guarantee its compatibility and coordination with the external

activities and business processes that define the demand and offer of products and services by an organization. As a result, it is a combination of two operational dimensions aiming at the rapprochement between stakeholders (internal or external), with the goal of integrating all activities and processes of supply chain management, whether performed by the organization itself or by its external suppliers.

Furthermore, the 4PL should aim bringing together the right people and know-how needed to challenge the state of the art, and drive the digital and cultural transformation of companies and marketplaces, and should offer its clients:

- Up-to-date market information (supply and demand behavior, available products and services, stakeholder integrity, etc.);
- Know-how about the market in the various areas of specialization (marketing, purchasing, production, among others) and across different sectors of activity (e.g.: construction, automotive, etc.);
- Means for the execution of transactions between companies (purchasing platform, data integration systems, etc.);
- Electronic applications to support operations management, decision making, systems simulation, data storage, and communication between stakeholders, ensuring the synchronization of operations and integration of processes.

Given the challenges and gaps that exist in the construction industry in relation to supply chain management practices, two solutions that currently represent a relevant opportunity for the development of the 4PL have been identified:

- An integrated e-marketplace, aiming to gather suppliers and consumers of different categories and sectors, respecting all the management criteria that are implicit in the exchange of services or goods, and contemplating all the elements necessary for their implementation - *Figure 7*;

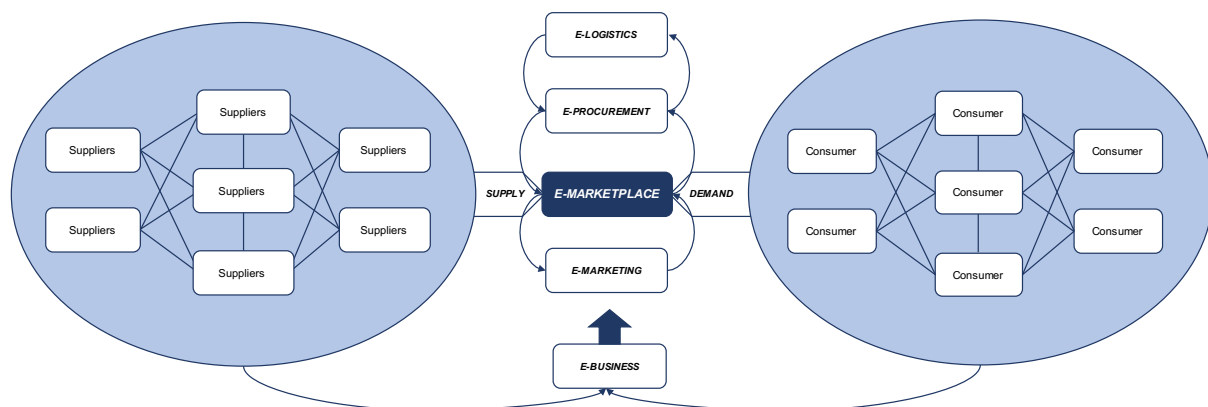


Figure 7 - Integrated e-marketplace map with key elements

- A production control application, which aims to solve the inherent difficulty in pointing out the performance of works and resources use in a site environment - *Figure 8*.

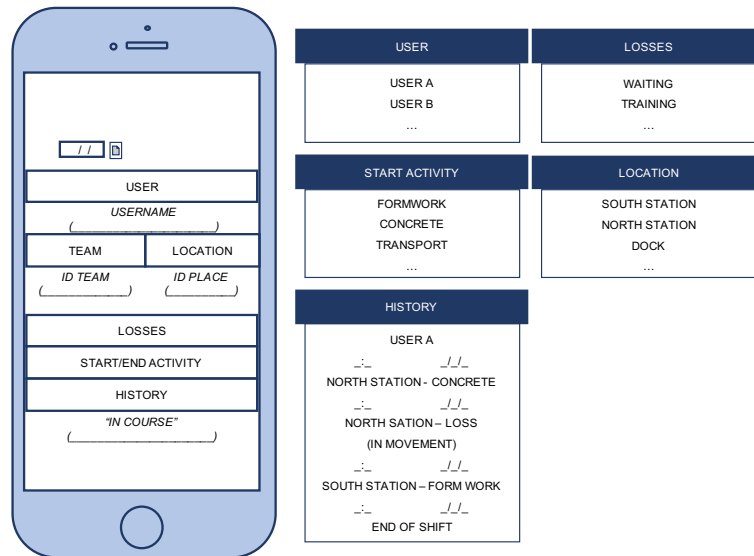


Figure 8 – Production control application menu and submenu selections

5. Conclusions

As a result of the reflection points addressed throughout the dissertation, it is considered that the work developed contributed to:

- Complement existing studies on supply chain management and their application to the construction industry:

- With the research it has been found that there are several studies on supply chain management and on the concepts and practices associated with it. However, many papers end up repeating themselves and adopting a too generalist approach, which becomes ambiguous without the consideration of practical cases and specific industries. As a result, existing studies on the application of supply chain management practices and methods to the construction industry are scarce and poorly detailed.

The conceptual foundations adopted in this dissertation are those that were considered to best describe the concept of supply chain management today.

- Define a model of analysis about the scope and framework of the supply chain management, based on 3 structuring elements: supply chain structure, supply chain management processes and management components:

- The supported study model for the definition of supply chain management matters aims to provide a structured and organized perspective in the construction sector and, although it is used exclusively for the construction phase, it should be useful as a basis for future studies and developments on the implementation of supply chain management across different entities, sectors or business segments.

- Raise a set of relevant opportunities for service providers, related to supply chain management, to evolve towards 4PL:

- Although the solutions presented for the development of the 4PL represent only the integration of the flow of resources and production activities, they are not the only ones likely to be introduced by this actor, whereby in parallel with the introduction of the 5 macro-processes of

supply chain management, a general survey of some electronic tools or technologies, that can be integrated by the 4PL is conducted. At the same time, within the solutions addressed, barriers and opportunities were identified to their implementation and development.

As a final note, as a result of the need to invest more in the parameterization and compatibility of the business structures of organizations, in their conversion to a digital environment and in the standardization and integration of generated data and actors, it is concluded that although the 4PL concept is not very common in the market and is not fully implemented as a service provider with full capacity on supply chain management and its outsourcing, there are several players in the market that gradually have been playing a relevant role in this regard.

Although it is not entirely clear who will take on the role of the 4PL, it is thought that the success of its implementation should be dependent on its ability, not only to develop solutions that can place it in a favorable strategic position with high visibility, but also in its capacity to integrate and promote other service providers and solutions with whom its clients already work, or who demonstrate greater competence for the resolution of the matters in question. In this sense, it is supported that both manufacturers of e-marketplaces (including procurement companies) and consulting firms are in a favorable position to become a 4PL. At the same time, it is thought that the real challenge for the 4PL's success lies in the need for capturing all market and supply chain actor's attention, while maintaining extensive know-how and technical capacity over the different sectors and business segments.

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