

A Brief Discussion on Supply Chain Management in Construction Industry

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Abstract. The importance of supply chain management (SCM) has been mentioned extensively within the scientific literature, particularly within the context of up companies' performance. Since the construction industry could be a key social and economic activity of each country, the implication of SCM methods is taken into account useful in achieving higher competitiveness of construction companies and construction sector as a full. Construction may be a worldwide activity with several special characteristics and it includes comes of dramatically differing types, sizes and complexities. Though the present literature suggests that the generic supply chains ought to be straightforward and linear, the fact within the construction sector is sort of completely different – a myriad of construction supply chains associated markets ought to be integrated by any construction firm once it delivers an answer to a finish customer/client. So the aim of this paper, so as steering for future analysis associated with supply chains in construction, is to review existing analysis and synthesize main approaches and findings. especially, this review seeks to screen existing studies (published in amount 2010-2018 mistreatment Pro Quest database) with respect to their a) level of research, b) analysis focus, c) variety of study/paper, d) the sample used, e) analyzed relationships, and f) the various varieties of construction subjects that are coated and linked into supply chains.

Keywords: Construction Firm's Performance, Construction Industry, Supply Chain Management, SCM, Literature Review

1. Introduction

There is little question that construction sector invariably includes a sturdy impact on the whole economy of each country, which it's a worldwide activity with several special characteristics compared with different economic activities. It is the largest economic industry in the world (Ahmed, Islam, Hoque, & Hossain, 2018). So as to enhance performance and productivity in construction sector, recent studies have highlighted the importance of adoption effective supply chain management (SCM) at intervals construction firms.

SCM is an idea that started within the manufacturing trade. It's seen as a rigorous innovation that's designed on previous changes like Total Quality Management (TQM) and Just-in-time (JIT) (Segerstedt & Olofsson, 2010). In step with (Mentzer et al., 2001) the supply chain is “the network of organizations that square measure concerned, through upstream and downstream linkages, within the completely different processes and activities that manufacture worth within the kind of product and services within the hands of the last word client.” Equally, a supply chain has been conceptualized as “a system whose constituent components embody materials supplies, production facilities,

Distribution services and customers connected via the feed forward flow of materials and also the feedback flow of information” (Croom, Romano, & Giannakis, 2000). However since the development sector includes comes of dramatically differing kinds, sizes and complexities and there's conjointly a high degree of subcontracting at intervals the business, the definition of construction supply chain may be a bit a lot of complicated. First of all, it is necessary to outline and perceive relationships between clients, consultants, contractors and subcontractors. Saad et al. (Saad, Jones, & James, 2002) investigated styles of these relationships in terms of the degree of collaboration and integration within the amount between 1960 and 2000 that is shown in Figure 1.

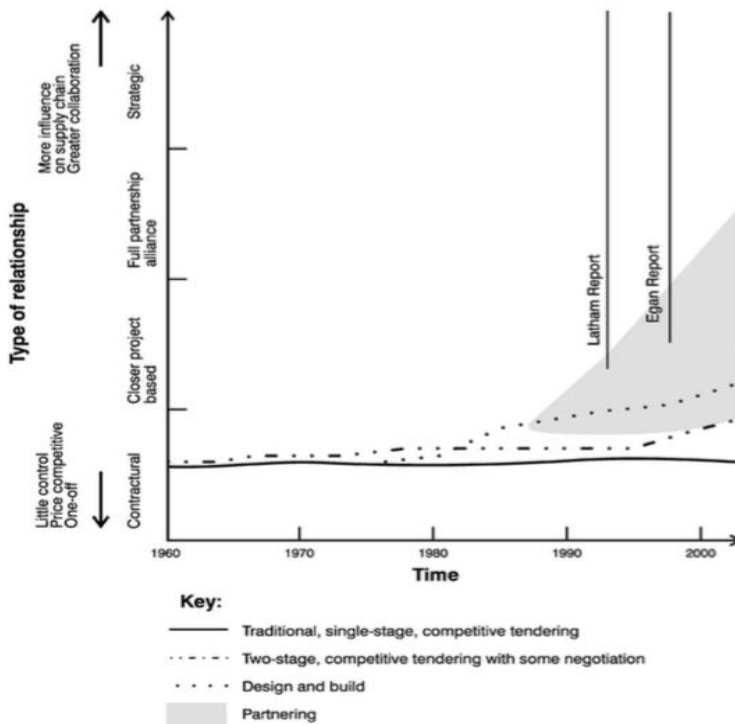


Fig. 1: Type of relationships in the construction industry (Saad et al., 2002)

In Figure 1 is shown that the standard single-stage approach to procure still dominated the approach of construction purchasers. Various acquisition approaches, like “two-stage competitive tendering”, “Design and Built”, “Management Contracting” and “Construction Management” represent some variations in relationships and roles between partners. The relationships mentioned on top of are literally the term best-known in construction sector as partnering that was the idea of development of SCM. Gil et al. (Gil, Gangopadhyay, Zhou, Gordon, & Nayak, 2010)) defines partnering as follows:

“Partnering involves two or more organizations operating along to enhance performance through agreeing mutual objectives, explanation the way of partitioning any disputes and committing themselves to continuous improvement, measurement progress and sharing the gains”.

SCM in construction is additional developed style of partnering and nowadays

there's obvious progress towards the adoption of the principles of SCM inside construction sector. In recent years, a tiny low however increasing variety of construction organizations began to adopt SCM ways in recent years to enhance their performance, however Papadopoulos et al. (Papadopoulos, Zamer, Gayialis, & Tatsiopoulos, 2016) expressed that there's a growing awareness of the requirement for changes inside the construction industry, specifically with respect to its current business processes.

The aim of this paper, so as provide to produce steerage for future analysis associated with supply chains in construction, is to review existing analysis and synthesize main approaches and findings. specially, this review seeks to screen existing studies (published in period 2010-2018 exploitation Pro Quest database) with respect to their a) level of research, b) analysis focus, c) style of study/paper, d) the sample used, e) analyzed relationships, and f) the various styles of construction subjects that are covered and connected into supply chains. The paper is unionized in four sections. In Section a pair of the construction supply chain landscape are shortly represented and a few definitions of supply chain management in construction industry are examined. Section 3 identifies the various bodies of literature during which construction supply chain studies have emerged thus far, whereas Section 4 presents the results of literature review in keeping with the abovementioned criteria and provides some conclusions we will draw from obtained results.

2. The Construction Supply Chain Landscape

As we tend to mentioned higher than, the construction industry has several special characteristics. It's usually argued that the construction industry is exclusive within the approach that it establishes comes to deliver one-off merchandise (Krishnakumar & Kuriakose, 2016), therefore a definition of construction supply chain differs from the origins. According to Xue et al. (Xue, Li, Shen, & Wang, 2005) there are three sorts of construction supply chain:

- The first supply chain – that delivers the materials that are incorporated into the ultimate construction product,
- The support chain – that provides instrumentation, experience and materials that facilitate construction, and
- The human resource supply chain – that involves the availability of labour.

The supply chain idea is usually closely connected with the production method inside industry. Figure 2 presents a schematic read of the method that's created of the operational activities of production inside construction sector.

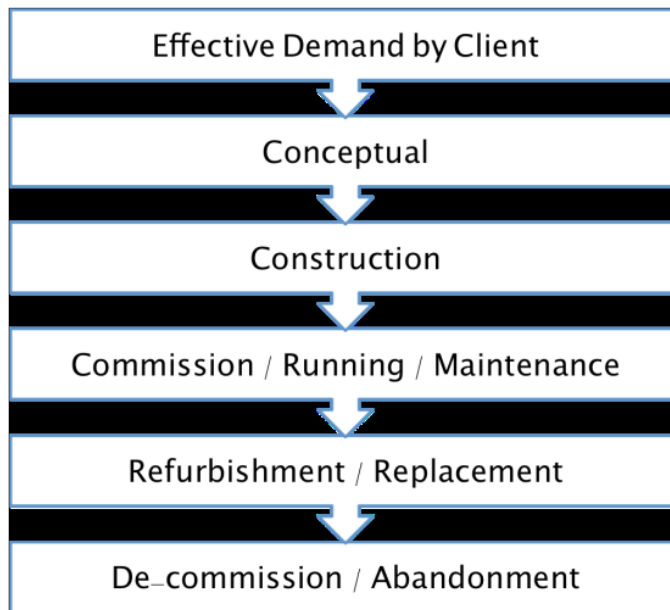


Fig. 2: Process chain of operational activities in construction (Croxtton, Garcia-Dastugue, Lambert, & Rogers, 2001)

The process shown in the Figure 2. is often explained as a supply chain and can be cyclical whereby several repetitions of the process are undertaken as facilities are modernized or replaced; or can terminate as is the case with many one-off private developments (Croxtton et al., 2001). (Ahmed, 2018; Papadopoulos et al., 2016) suggest a “typical” construction supply chain (Figure 3).

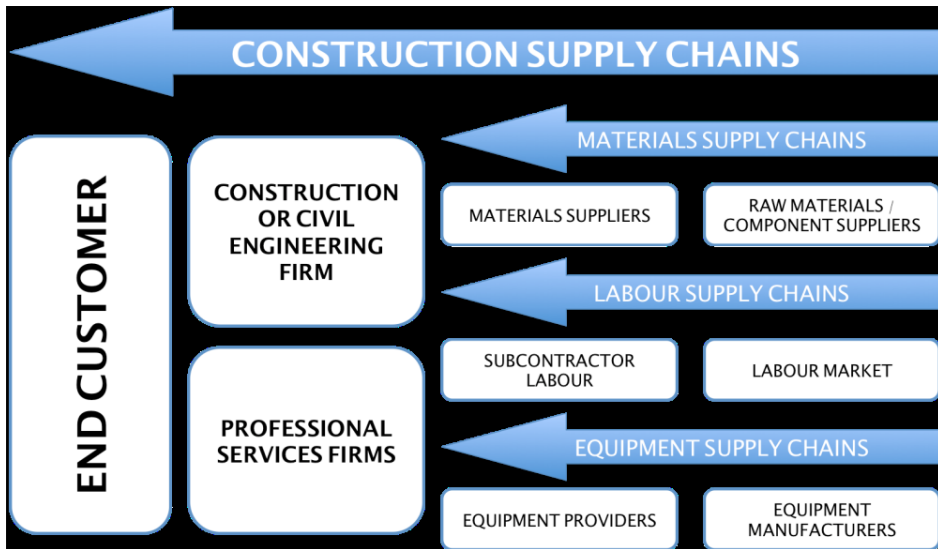


Fig. 3: The myriad of construction supply chains (Papadopoulos et al., 2016)

In the construction industry it's the consumer who takes the initiative to start out a construction project, and this results in the frequent conceptualization of the construction supply chain as a method expressly beginning and ending with the top user as shows Figure three. The stage end customer includes all customers of construction comes. These clients generally source their construction necessities from extremely competitive construction supply markets that the construction project provides the desired practicality to support their business. Moreover, construction or technology firm includes all technology and construction companies that deliver comes to the top client. These companies play the 'integrating' role for all the constituent construction supply chains and generally operate at intervals an extremely competitive marketplace. Skilled services companies includes all skilled services companies that offer engineering, design, planning etc.

It has become that the most important characteristic of the construction supply chain is that every consumer represents distinctive client with unique necessities. And therefore the construction supply chain have to comply with that so as to has simpler and additional economical. The dearth of a universal definition of

construction supply chain management is partially thanks to the manner the idea of the supply chain has been developed. Such, the idea of construction supply chain has been studied type totally different views at intervals different relevant bodies of the literature, as are represented within the next section.

3. Bodies of Literature Associated with Construction Supply Chain

Trying to clarify methodology and helping in making an agenda for future analysis, we present a content summary of the prevailing literature on construction supply chains. We've got started out an indicative delineation in Table 1, identifying the analysis issues at intervals every of the six areas that we have identified within the existing literature to relate to the sector of construction supply chain.

Table 1: Principal component bodies of construction supply chain literature

<p>Supply Chain Management</p> <ul style="list-style-type: none"> • An examination of a modular supply chain • The role of supply chain management in construction • Construction supply chain collaboration and management • Success factors in implementation of strategic partnerships • ICT systems in construction supply chain management • Supply chain management and risks in the construction industry • Safety Decision Points in the Construction Supply Chain • McKinsey 7S Model for Supply Chain Management of Local SMEs Construction Business • Demand uncertainty in construction supply chains 	<p>Project Management</p> <ul style="list-style-type: none"> • Improving construction supply chain collaboration and performance • Interdependence in supply chains and projects in construction • Design and delivery solutions • Principles for the design and operation of engineer-to-order supply chains
<p>Sustainability</p>	

<ul style="list-style-type: none"> • Developing sustainable supply chains • Barriers to Green Supply Chain Management in the Construction Sector 	<p style="text-align: center;">Knowledge Management</p> <ul style="list-style-type: none"> • Supply chain capital in construction industry • Organizational learning • Generative Mechanisms of the Adoption of Logistics Innovation
<p style="text-align: center;">Construction supply chain behavior</p> <ul style="list-style-type: none"> • Multi-team communications in construction design under supply chain partnering • Construction supply chain relationships • Implementing supply chain partnering in the construction industry • Protecting workers through supply chains • Safety Climate Instrument (mechanism to measure safety attitudes) for the Construction Supply Chain 	<p style="text-align: center;">Special scope of construction</p> <ul style="list-style-type: none"> • Tunneling construction project's supply chain • Construction supply chain in the public procurement • Construction supply chain in the industrialized construction projects • Supply chain integration in the construction and shipbuilding industries • Hydropower Development Construction Supply Chain • Off-site precast concrete production as a case study for construction supply chain

In this review, we didn't only concentrate on applying the content analysis to the literature, however we have a tendency to additionally involving with screening and describing the analytical details of existing studies so as to find possible future analysis. The matrix shown in Table 2 has been obtained by combining these two dimensions and it'll be accustomed summarize the placement of publications in terms of the analysis subject and with respect to the elements of exchange that they take into account.

Table 2: Construction supply chain content matrix

Author	Research subject	Research method	Sample	Relationship
(Erik Eriksson, 2010)	Improving construction supply chain collaboration and performance	Empirical	The three surveys (responded to by 26, 29 and 32 project participants), the three workshops (attended by 15-20 participants), 12 interviews	Several aspects facilitate the achievement of more than one core element
(Segerstedt & Olofsson, 2010)	Interdependence in supply chains and projects in construction	Case study	The plasterboard supply chain	-
(Shukor, Mohammad, Mahbub, & Ismail, 2011).	How construction design under supply chain partnering can be improved through communication	Empirical	One case study, two rounds of questionnaire survey (26 answers)	Partnering can eliminate many communication barriers and has a positive impact on social collaboration in the construction design process
(Meng, Sun, & Jones, 2011)	Research review on construction supply chain relationships	Conceptual		
(Doran & Giannakis, 2011)	The establishment and implementation of an aggregated strategic alliance and its success factors	Case study	Strategic alliance by ten partners	Centralized communication, efficient IT support and trust among the partners are shown to be major factors contributing to the success of the alliance

(Meng, 2012)	Hydropower development construction supply chain	Simulation	Three supply chains	-
(Lingard, Cooke, & Blismas, 2012)	The degree to which supply chain practices are aligned with modular construction	Case study	Five modular construction supply chain	
(Aloini, Dulmin, Mininno, & Ponticelli, 2012)	Identifying variables impacting the productivity of tunneling construction projects	Case study	One tunnel project	
(Sarhan & Fox, 2013)	Establishing public construction supply chain	Action research	One public project (school estate)	
(Ali, Al-Sulaihi, & Al-Gahtani, 2013)	The key safety decision points in the construction supply chain	Case study	Large wastewater overflow tank	
(Eriksson, 2013)	Investigating the risk factors affecting the implementation of SCM principles	Conceptual	140 research articles	
(Fewings, 2013)	Evaluating the barriers to the adoption of green supply chain management	Empirical	32 barriers to the adoption of GSCM were classified by 11 participants in 3 workshops	Identified external and internal factors that are critical barriers
(Fulford & Standing, 2014)	Developing an innovative crew allocation system	Case study	Off-site precast concrete production	

(Govindan, Kaliyan, Kannan, & Haq, 2014)	Exploring the theory and current practice of organizational learning in UK construction supply chains	Empirical	Interviews with 7 construction companies	
(van Vught & van Weele, 2015)	The impact of demand uncertainty on supply chain performance	Simulation	2 material distribution companies	Lead times are particularly sensitive to fluctuations under conditions of low demand and higher inventory costs result in a negative exponential relationship between increasing demand and cost efficiency
(Dadhich, Genovese, Kumar, & Acquaye, 2015)	Improving processes adopted by a small/medium enterprise (SME) contractor for the control of defects in its supply chain	Action research	6 different supply chain participants (architect, services designers, contracts director, site manager, subcontractors and material	
(Krishnakumar & Kuriakose, 2016)	The integration of information flows in relation to material management throughout the construction industry supply-chain	Case study	Industrialized construction project	

(Papadopoulos et al., 2016)	The McKinsey 7S model to study the successful business strategy of supply chain management	Empirical	Local SME construction shops	Strategy was scored highly
(Akan, Dhavale, & Sarkis, 2017)	Implementation of SCP as understanding managerial and intra-organizational dynamics	Action research	Dutch housing association	
(Mathiyazhagan, Datta, Singla, & Krishnamoorthi, 2018)	The impact of product modularity on Supply Chain (SC) integration	Case study	Five companies The higher the product modularity, the lower the SC integration	
(Nguyen et al., 2018)	Identifying the factors supporting the effective management of health and safety	Case study	Two case studies on one contractor	

As it can be seen from the matrix, 44% of the analyzed papers present case studies, 23% are empirical, 15% are theoretical, 11% are action researches and 7% are simulations. An overview of the studies regard to the project subjects or construction company, they cover is presented in Table 3.

Table 3: Construction project subjects in construction supply chain studies

Public projects	Lean projects	Modularity constr.	Tunneling/bridge	Water projects	Shopping centers	Housing sector	Strategic alliances	BIM	Material distributors	Contractors	ETO
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(Erik Eriksson, 2010)		√										
(Segerstedt & Olofsson, 2010)			√									
(Shukor et al., 2011).									√			
(Meng et al., 2011)										√		
(Doran & Giannakis, 2011)				√								
(Meng, 2012)						√						
(Lingard et al., 2012)										√		
(Aloini et al., 2012)										√		
(Sarhan & Fox, 2013)	√											
(Ali et al., 2013)							√					
(Eriksson, 2013)				√								
(Fewings, 2013)							√					
(Fulford & Standing, 2014)							√					
(Govindan et al., 2014)				√								
(van Vught & van Weele, 2015)										√		
(Dadhich et al., 2015)		√										
(Krishnakumar & Kuriakose, 2016)					√							
(Papadopoulos et al., 2016)											√	
(Akan et al., 2017)							√					
(Mathiyazhagan et al., 2018)				√								
(Nguyen et al., 2018)									√			

Summarized results with respect to the construction project subjects veiled by

present construction supply chain studies show that mostly of research papers target their research on contractors companies and also on material distributors. According to construction projects, we find that an equal number of studies research housing project, tunneling/bridge projects or public projects.

4. Conclusion

Because SCM implementation within the housing industry has been scattered and partial to this point, the intention of this review paper was to present an outline of the context and focus of previous supply chain studies that are set inside a construction context, and to produce a reference guide for more analysis. The authors shall update and extend this literature review, and therefore any provision of knowledge associated with construction supply chains is welcome and extremely appreciated.

One of the foremost important findings from our literature analysis has been the relative lack of theoretical work in this field in comparison to empirical based mostly studies. More research may aim to check the work of supply chain management methods with existing construction management methods. Specifically, because of the fragility of the many construction systems, future studies could shift specific focus the role of supply chain management methods in achieving construction property at the project level and conjointly expand the main focus to supply chain management methods utilized in construction systems.

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