SUPPLY CHAIN CONSTRAINTS IN THE SOUTH AFRICAN CONSTRUCTION INDUSTRY – PERSPECTIVES FROM SUPPLY CHAIN PRACTITIONERS

RID POOE* & P PILLAY**
*UNIVERSITY OF JOHANNESBURG
**VAAL UNIVERSITY OF TECHNOLOGY

Abstract

In the face of slowing economies globally, the construction industry faces many challenges such as socio-economic stress, resource shortages, institutional weaknesses and a general inability to respond to key issues. These have intensified and become more severe in recent years. Empirical research in supply chain management points to barriers that limit construction industries in developing countries such as South Africa. This paper aims to explore supply chain constraints in the South African construction industry. Relevant literature was reviewed and insights from 15 experienced supply chain practitioners were elicited by means of semi-structured interviews. Content analysis was employed using the ATLAS.ti (version 7) software to analyse qualitative data. Six themes emerged from the interviews, which include lack of investment in supply chains, lack of supply chain innovation process constraints, supply chain change management, supply chain collaboration, supply chain leadership, and time management. It is recommended that construction companies adopt supply chain management systems, integrated solutions, and collaborative project management tools and technologies.

Keywords: construction industry; construction projects; supply chain constraints; supply chain management

1.   INTRODUCTION AND BACKGROUND

Notwithstanding the fact that the construction industry has been in a slump since 2009 in South Africa construction remains one of its largest industries contributing significantly to employment and growth, (Haupt & Harinarain 2016:80). According to Brooks and Spillane (2015:1220), the impact of the recent global recession on the construction industry has been particularly pronounced. However, in many countries the construction industry contributes a significant percentage to gross domestic product (GDP), with some estimating the contribution to between 6% and 9% of the GDP in developing countries (Lopes, Oliveira & Abreu, 2017:658; Mojtahedi & Kabirifar 2019:1). Between 2008 and 2016 the construction industry accounted for around 8% of total formal employment and around 9, 6% on average of GDP in South Africa, employing some 1.4 million people (Construction Industry Development Board (CIDB), 2017; Durdyev, Zavadskas, Thurnell & Ihtiyar 2018:2). Yet, according to Saidu and Shakantu (2017), the construction industry remains characterised by fragmentation, inefficiency, cost and time overruns, among other problems. In the face of slowing economies globally, the construction industry faces a number of challenges such as socio-economic stress, resource shortages, institutional weaknesses and a general inability to respond to key issues, with the recent years seeing these challenges intensifying and becoming more severe (Al Ahbabi, 2014:15).

Not surprisingly, policy makers and researchers alike have sought to gain a deeper understanding of the barriers and constraints facing the construction industry, both at the macro-economic and institutional levels. In this regard, Reinaldo, Fernando, Alves and Moellmann (2012:2) observed that scientific research remains an important avenue for the generation of new perspectives. Since supply chain performance is often positively associated with business performance (Chinomona & Pooe 2013:3), an understanding of the constraints behind its related challenges is necessary if the performance of the industry is to be improved. Alaloul, Liew and Zawawi (2016:2690) observed that many problems encountered on large construction projects are associated with the lack of a proper coordination practice within supply chains and between supply chain partners.

More often than not, project delays, cost overruns and non-conformance to quality that lead to poor performance and dissatisfied customers are common problems in the construction industry (Enshassi, Sundermeier & Abo Zeiter, 2017:12; Mojtahedi & Kabirifar, 2019:1). Furthermore, there is a perception that the project delivery process in construction management is highly inefficient compared with other sectors such as manufacturing and retail. Mojtahedi and Kabirifar (2019:2) noted that the significance of these inefficiencies within the industry is accentuated by cost and time overruns.

Removing these inefficiencies requires the application of supply chain management. Although there are a number of studies from different countries that have investigated various areas within the supply chain management arena in the construction industry in the recent past (e.g. Emuze & Smallwood, 2013:513-522; Moneke & Echeme, 2016:233-249); Papadopoulos, Zamer, Gayialis & Tatsiopoulos 2016:528-534; Owen, Morgan & Killip, 2017:613-622; Kadangwe & Emuze, 2017:56-67), there have been relatively few studies that investigated supply chain constraints in the construction industry (Amade, Akpan, Ubani & Amaeshi, 2016:1-19; Pillay & Mafini, 2017).

According to Ofori (2015), scientific research focusing on the construction industry remains an important avenue for the generation of such new perspectives. Hence, the current study was both relevant and significant in that it is intended to identify constraints existing in the construction industry supply chain with a view to proposing innovative ways of minimising them, thereby contributing to the better performance of that industry. The remainder of this paper is organised as follows: First, relevant literature on the characterisation of the South African construction industry and supply chain management is reviewed. This is followed by the description of the research methodology employed. Research findings are then discussed followed by recommendations.

2.   LITERATURE REVIEW

Supply chain management integrates key business processes and activities into synchronised processes to satisfy the customer's needs (Pakurár *et al.*, 2019:2). These include initial raw material extraction to the end customer, including intermediate processing, transportation and storage activities as well as final sale to the end customer (Shahriarpour & Tabriz, 2017:266). According to Du Toit and Vlok (2014:26), supply chains vary in size, length, and level of complexity; and that a firm producing multiple types of products is bound to be part of multiple supply chains, depending on the materials and services used to make and distribute the products. The essence of supply chain management is that it is strategic in nature and that customer value creation remains a core driver of the entire supply chain operation (Min, Zacharia & Smith, 2019:49). Appreciating this fact often requires a significant shift in the mind-set of the participants toward collaboration, teamwork and mutual benefits. It is hardly surprising that only few sophisticated applications have been reported in the construction industry (Van Weele & Arjan, 2012:24).

In this regard, Pal, Wang and Lian (2017:1227) have observed that, more than ever before, construction projects seem to pursue collaborative relationships between main contractors, sub-contractors and suppliers, albeit at a slow pace. For example, according to Boyce, Mano and Kent (2016:2), collaborative relationship in procurement is still not yet widely embraced, where firms can benefit mutually by reducing costs and inventory, and where the customer consequentlyt receives the best value for money. Since there is no single procurement strategy that works best for all situations in construction, a careful analysis of client needs is required before implementing any procurement strategy. In this regard, Al Ahbabi (2014:20) posits that good procurement practices are required in order to reduce the overall cost of projects, the overall economic efficiency of the construction industry and to ensure that when complete, projects are fit for purpose. Procurement is one area where the greatest opportunities for cost reduction and enhancing value of the whole supply chain exist (Boyce *et al.*, 2016:2).

Mbhele (2014:214) states that value of optimisation in the total supply chain cannot be materialised without the necessary processes associated with the upstream, midstream and downstream flow of information, physical goods and services from multiple channels to the end consumers. Since managing the dynamic interrelationships and interactions that exist among suppliers can become complex, this would require effective integration of project activities into the larger framework of supply chain management. For instance, given the crucial role of sub-contractors in construction projects, any improvement in overall performance requires recognising the fact that the main contractor has to depend on the reliability of sub-contractors to complete the project successfully (Patel & Patel, 2017:1228). Hence, Vilasini, Neitzert, Rotimi and Windapo (2012:31) hold that subcontractor involvement and integration requires early procurement by subcontractors whose selection should be based on criteria such as innovation, ability to collaborate and the alignment of strategic objectives with key performance indicators identified for the project, and not just on the lowest price.

In project management, the logistics function becomes rather more complex as huge quantities of materials, components, equipment and services are required for the construction. According to Steyn and Lourens (2017:3), all materials converge on the construction site where the facility is assembled from incoming materials and projects requiring made-to-order supply chains, with every project creating a new facility. This requires a thorough understanding of client requirements and includes the elimination of waste throughout the supply chain with a view to reducing costs and ensuring timely completion and delivery of projects. The importance of logistics is underscored by Fadiya (2012:4) who contends that little attention has been paid to supply chain management (SCM) or logistics, where the construction industry only recognises the final leg of materials' delivery as being important. Fadiya (2012:7) also argues that while there has been developments in terms of ICT systems, limited work has been done on their systematic evaluation prior to implementation. This denotes that the optimisation of the usage of transport vehicles can significantly improve construction efficiency.

In addition, effective and efficient inventory management is key for successful construction projects since materials account for about 55%-60% of the total construction cost (Kumar, Priya, Kumar & Ravekumar, 2018:900). The improper handling and storage of materials in the construction site has made it difficult to track and locate materials as and when they are needed (Abhilin & Vishak, 2015:910). A timely flow of materials is an important concern of material management (Smita & Pataskar 2013:96). Again, poor handling and management of construction materials affects the overall performance of construction projects in terms of time, budget (cost), quality and productivity (Patel & Patel, 2017:147). Materials wastage in construction projects could results in huge financial setbacks, as well as have a detrimental effect on the health and general environment (Chaudhari & Mata, 2016:64). The lack of or incomplete up-to-date information regarding on-site stock is one problem associated with inventory management for construction projects, and according to Liwan (2015:24), the implementation of technology such as bar coding for material tracing and tracking in construction projects can only facilitate and improve existing materials management practices.

The temporary project-based nature of construction projects seems to hinder the integration of construction supply chains (Blowfield, 2013:19; Yadav & Ray, 2015). In addition, Heng, Wang and He (2013:157) observed that since construction supply chains are highly dynamic in that organisational structures as well as project teams change frequently, it is unlikely that the participants who work together on a project have enough time to build sufficient trust and to share information willingly. Yet according to Sharma, Garg and Agarwal (2012:193), firms depend on their supply chains to survive and thrive since every firm forms part of one or more supply chains. In this regard, Kapustina, Chovancová and Klapita (2017:56) posit that while it is important to understand the current functional state and interrelationship of the various elements of the supply chain system it is also necessary to address the optimisation of individual production processes within the supply chain. To this end, Kapustina *et al*. (2017:57) suggest the need to identify the main causes of constraints or barriers in the context of supply issues.

3.   RESEARCH DESIGN AND METHODOLOGY

3.1   Research approach

This study adopted an exploratory qualitative research design, which enables an in-depth understanding of a situation (Sutton & Austin, 2015:226) and which, according to Creswell (2010:84), is used when a researcher examines a new interest or when the subject of study is itself relatively new and unstudied. Purposive sampling was used in this study to select participants. According to Creswell and Plano Clark (2011:35), purposive sampling which involves identifying and selecting individuals whose knowledge or experience about a phenomenon under investigation, was used in this study. The researcher's knowledge and experience of the South African construction industry enabled and facilitated relatively easy access to senior managers and high profile people, including chief procurement officers, who participated in the study. The participants were senior managers drawn from firms in the construction industry. Fifteen (15) participants were thus selected from construction companies. Semi-structured interviews were conducted. Table 1 shows the profile of the participants.

Participant code	Position occupied	Number of years in construction industry	Province
P1	Logistics manager	14	Gauteng
P2	Procurement analyst	12	Kwa Zulu-Natal
P3	Commodity manager	13	North West
P4	Senior buyer	10	Western Cape
P5	Head of procurement	14	Gauteng
P6	Procurement analyst	12	Mpumalanga
P7	Regional buyer	12	Easter Cape
P8	Chief Procurement officer	23	Gauteng
P9	Commodity manager	12	Easter Cape
P10	Chief Procurement officer	27	Limpopo
P11	Operations manager	16	Limpopo
P12	Head of Sourcing	15	Western Cape
P13	Head of procurement	19	Free State
P14	Senior buyer	11	Gauteng
P15	Plant and assets executive	22	Mpumalanga

Table 1 - The profile of the participants

Source: Own compilation

According to Lee and Lings (2008:228), semi-structured interviews describe a range of different forms of interviewing whose defining characteristic is that they have a flexible and fluid structure. Interviews were recorded using a digital voice recorder. The transcription process involved the close observation of data through repeated careful listening (and watching), and formed an important first step in data analysis. As an interpretive act rather than simply a technical procedure, transcribing can lead to noticing unanticipated phenomena (Myers, 2008:38). According to Gunawan (2015:4), trustworthiness entails validity and credibility of information provided to an enquirer and consists of four elements: credibility, conformability, transferability and dependability. In the current study, credibility was ascertained through the triangulation method. Triangulation is a way of enhancing validity by looking at the issue from different angles – for instance, types of method or different analysis techniques. It can also be used to enhance the richness of the data set (Lee & Lings, 2008:239). Member-checking was applied when the researcher interacted with the participants during the interview planning stage and after interviews in order to gather any additional material from written feedback and complements (Corbin & Strauss, 2008:292). To achieve confirmability, an audit trail was completed for all interviews by ensuring that participants were given the chance to go through their individual interview transcripts (Lincoln, Lynham & Guba, 2011:38).

3.2 Data treatment

Content analysis was employed using the ATLAS.ti (version 7) software used for analysing qualitative data, especially involving large sections of textual, visual and audio data. The use of ATLAS.ti was appropriate for this study considering the amount of textual data generated by the interviews (Paulus & Lester 2016:410). In using this software, a three-step process suggested by Sinkovics and Alfoldi (2012:829) was followed. The first step was to identify the recurrent categories that gave meaning to the data. Next was the development of the coding system which involved the attachment of labels to sections in the data on the basis of meanings that the researcher deduced from the data (Braun & Clarke, 2014:23). Then, when all the data had been organised and coded, phrases that appeared similar were then grouped into their identical themes. Themes emerging from the coding were documented by the interviewer. This procedure was repeated until a point of saturation was reached, which is the point at which the themes began to appear repeatedly, indicating that no further analyses were necessary (Sutton & Austin, 2012:229). The extracted themes represented the main findings of the study.

4. RESULTS AND DISCUSSION OF THE RESEARCH FINDINGS

The present study identified a few challenges that the industry needs to overcome. These include lack of investment in supply chains, lack of supply chain innovation process constraints, supply chain change management, supply chain collaboration, supply chain leadership, and time management.

Theme 1: Lack of investment in supply chain systems

The first theme emerging from the study was labelled as above since participants' sentiments suggested the general lack of investment in supply chain management systems. As to whether the firm has any system in place to identify and manage the supply chain constraints, the following responses were elicited from participants, denoted by a letter P:

'Our company has no proper system in place. They did contract for a world class supply chain system, implemented it partially and then cancelled the contract before realising any of the benefits of the systems. **(Participant 1 (P1))'.**

In this regard, a commodity manager and a senior buyer respectively expressed themselves as follows:

'We use Buildsmart which I am told is a world class system. I saw a report from head office which says it is a project management tool and not for procurement. I just use the system as it is and I don't know who does what to the system. **(Participant 3 (P3)**; we have a buying system and across the company, we have about eight (8) systems. We tend to pull procurement data into one central reporting system but it is problematic as all we have is supplier spend, not item spend **(P4)'.**

These responses show that construction firms have been reluctant to invest in or even take full advantage of supply chain management systems that would enable them to streamline processes with a view to saving time and cost. The lack of investment in supply management systems reflects the fact that construction firms still do not have a strategic view of supply chain management as it would seem that in general there is no sense of how supply chain strategies can positively affect a company's performance and profitability. In some cases, it also appears that even the buying function does not enjoy a strategic presence within some organisations, therefore procurement systems remain substandard. Ibem and Laryea (2015:377) observed that compared to other industries, the construction industry in South Africa is fairly slow when it comes to the adoption of supply chain management systems and other forms of best practice. Without an effective supply chain management system, critical areas such as spend analysis and strategic sourcing will always be hamstrung. The adoption of best practice will require construction firms to realise that they need to embrace the supply chain management philosophy and practice.

Theme 2: Lack of supply chain innovation process constraints

The second theme emerging from the study was labelled 'lack of a supply chain innovation process'. This theme emerged from the following responses were elicited from participants.

A procurement analyst noted:

'My view is that this industry is trapped in a time warp, that have not adopted world class business practices and principles and that they continue to do the same thing over and over and expect different results. I joined at the height of the collusion drama. It was clear that the 'free lunches and high margins were over' yet the company failed to tighten its belt and focus on the core cost drivers to allow the company to effectively compete **(P2)'.**

He went on to say:

'The industry is characterised by the same key staff moving from one company to the next- new blood, hence new thinking is not happening on a regular basis'.

Finally, the commodity manager retorted:

> 'Nothing has fundamentally changed over the past 10 odd years of my experience. They keep doing the same things over and over **(P4)**'.

Without a sense of how supply chain strategies can positively affect a company's performance and profitability, the sector will not invest in expensive supply chain systems. Until such time that construction realises that supply chains encompass more than just the buying function, they will find it hard to migrate to world class best practice. Given that even the buying function does not enjoy a strategic presence within some organisations, procurement systems remain substandard (Chong & Greece, 2014:16). Koutsogiannis (2017:online) has also observed the unwillingness of the construction industry to direct its resources, both financial and time related, towards innovation. He asserts that if construction firms would take innovation seriously, this would instantly boost the whole project management process and it would lead to the creation of a more skilful and productive labour force.

Theme 3: Supply chain change management

The third theme emerging from the study was labelled 'lack or supply chain change management'. This theme emerged from the following responses were elicited from participants:

> 'Some of these projects were aimed at making the entire supply chain report to a centre led structure, implementing new systems (contracts cancelled) and further implementing world class processes through all operational functions. This also failed as it required system and process changes and whilst the company spent money to determine the problems that existed in its current processes, it refused to spend money to correct same **(P6)**'.

> 'Construction is immature in terms of business skills, business processes, business experience outside of construction and the ability to embrace new concepts **(P13)**'.

Change management within the sector is clearly a problem area and resistance to change is rife in some organisations. This stems from historical practices and management practices which the sector refuses to change. Again, given the lack of exposure by entrenched and long serving managers to world class management principles and practices, including advancements in supply chain over the past decades, these new practices will remain foreign to most long serving personnel.

Traditional change management methodologies have been deliberately set up to fail or resisted until they are dropped. Therefore a more stringent manner to enforce change is required in the sector and in some organisations. However, it also important to note that while change is good, given the magnitude of the constraints observed, if not managed properly through a formalised change management process, it will have considerable impact as it disrupts work and affects its orderly sequence, adversely impacting on productivity and causing schedule delays and cost overruns. Hence, change management remains ineffective because most of these process are seemingly absent. While Hao, Shen, Neelamkavil and Thomas (2008:392) acknowledge that developing an effective construction change management process is a challenging task because it requires an integrated solution, they do posit that an integrated change management system requires technical support from different technologies, including collaborative project management tools and technologies.

Theme 4: Supply chain collaboration

The fourth theme emerging from the study was labelled 'lack or absence of supply chain collaboration'. This theme emerged from the following responses, elicited from the regional buyer and chief procurement officer respectively:

> 'There are three distinct supply chain/ procurement structures in our company- the first is the strategic sourcing division made up of highly qualified strategic sourcing specialists and commodity managers reporting to corporate as a support function to the entire group. The second is the operational buyers reporting to each business unit that is more administrative in nature. They are made up of poorly qualified or trained individuals with an average of 10 to 20 years of service. They are generally clerks that 'became buyers'. The third are the engineers, quantity surveyors, site agents, commercial and contracts managers that appoint sub-contractors and decide the suppliers for high value bulk items. This tends to cloud the

supply chain as policies, processes, actions, orders as well as suppliers are not visible due to poor systems **(P7)**'.

'Problematic as there is a constant war between operations, buyers and strategic sourcing. Without a firm structure anything we do is hitting a brick wall. I think half of strategic sourcing's efforts are wasted as buyers ignore recommendations **(P10)**'.

Some respondents observed a reluctance to collaborate and share information with their peers. One specific issue mentioned by the participants was that working collaboratively to pre-qualify existing supply chains may potentially reduce the aggregate time necessary to assess the capabilities of suppliers and sub-contractors. In doing so the procurement community will be able to focus most of their efforts on the formal tendering process and procuring the best value. Notably within South Africa, as the construction industry gains significant growth, there should ideally be more time available to spend on advanced supply chain management, developing long-term relationships, sharing risk and opportunity and unlocking innovation to provide the best solutions for clients and stakeholders.

Wu and Weng (2010:392) further noted that within a supply chain, inter-organisational trust is important in maintaining a competitive advantage. If trust is developed through contacts between parties, it then becomes a bond or a tie that brings partners together. Bonding can take two forms: structural and social (Van Weele, 2010:121). Structural bonds are those economic and strategic ties that link buyers and sellers, such as legal contracts and agreements. Zhang and Chen (2009:21) explained further that as flawed as the individual entities of a construction supply chain may be, they are even more troublesome because a new supply chain or operations component must be developed each time a new project begins. The reality is that the learning that takes place in manufacturing is circumvented in construction by the changes that occur from one project to the next.

Theme 5: Supply chain leadership

The fifth theme emerging from the study was labelled 'lack or supply chain leadership'. This theme emerged from the following responses were elicited from participants:

'Leadership and providing visible support for supply chain initiatives and also visibly dealing with non-compliance **(P1)'.**

'A lack of buy in and management understanding of what we do. Irrespective of how qualified or experienced an individual is in this company, we are considered second class citizens in that only contracts' managers, QS's, engineers etc. are respected. Titles mean a lot in this company **(P5)'.**

Furthermore, participants observed that top management of firms involved in a project rarely commit themselves to mutual objectives. It was observed that problems are not constantly resolved at their level of occurrence and open book costing is not used by project parties. The participants noted that 'reinventing' the wheel of past mistakes is not avoided and lessons learnt are not implemented. Performance measures on projects are not consistent, while performance reviews are not conducted, either formally or informally. An established competitive advantage means little if the construction firm is not able to sustain it from project to project, thus construction industry leaders must retain a fundamental spirit of anticipation (instead of reaction) to changes and problems (Wu & Weng, 2010:92). Realising that most major advances result from small changes over time, the construction industry must create an environment of continuous project and process (work method) improvement. This requires employee training and empowerment as these small changes will more effectively come from the quality of the work force. It is also clear from the findings that the implementation of management based solutions has not had a justifiable positive impact on the construction industry and may not be an efficient solution when dealing with supply chains. Mabin *et al.* (2010:169) indicated that management based thinking may even be repelling the transformation into a performance based environment. The research also conjectures that leadership based solutions may be more successful. Leadership based solutions also include information based solutions where decision making, management and external control are lessened but supervision, independence and support increases

Theme 6: Time management

The sixth and final theme emerging from the study was labelled 'time'. This theme emerged from the following responses were elicited from participants:

> 'Time is an issue that's not always there because as soon as you get a project there are a lot of things that needs to happen before you actually do the start-up. So time is an issue but if you have your processes and your data in place already then there is no reason for it to not work better **(P2)**'.

> 'There is not enough time for the estimators or estimating team to put the tender enquiry documents together properly. So when you eventually as the QS receive the subcontractor documentation, you have to have discussions with the subcontractors or engage with them in order to conclude a contract **(P5)**'.

> 'So I think the time required to put a proper bid or RFQ together is usually too short. So that is from handover from tender to execution? See I think from an execution point of view we generally get led by who is the cheapest **(P9)**'.

Effective time management is vitally important for construction project (Chin & Hamid, 2015:34). Gligor and Holcomb (2012:17) add that delays are costly and are specifically addressed in contract documents in anticipation of liquidated and other damages. Pricing in construction can be lump sum, cost plus, negotiated, or unit price. According to Gligor and Holcomb (2012:17), all pricing in construction depends on the time that the contractor determines it will take to complete a job. Barring any circumstances caused by the project owner and outside of the control of the contractor, the contractor must meet the time set by the project owner or lose money. Time factors are even more complicated in construction because the working environment may be outside for part or all of a project, which means that progress, is influenced by weather conditions.

5. CONCLUSIONS AND RECOMMENDATIONS

This study focused on the constraints within the supply chains in the South African construction industry. Since empirical research in this area remains scant, especially in South Africa, this study hopefully provided some basis upon which further local research can be conducted for the improvement of supply chain management and project performance in the construction industry. While the discourse based on empirical research on the topic of supply chain constraints is still largely focused on manufacturing and production environments, the discourse on construction remains largely at a theoretical level.

This study investigated the constraints within the supply chains in the South African construction industry. It reflected on the vital contribution that the construction industry makes to the South African economy as a whole in a number of ways such as building the needed infrastructure for private and commercial use, contribution to GDP and employment, both formally and informally. Literature was reviewed on the nature of the construction industry in the country as well as the importance of supply chain management for individual firms and the industry as a whole. The article also outlined the qualitative research methodology approach employed for the study, after which the empirical findings were reported. The analysis of the primary data collected yielded six major themes emerging from the data. The findings were analysed against the relevant published literature to see whether the findings of the present study are in congruence with the relevant published literature. Direction for future research was therefore suggested and recommended.

In light of the foregoing, the study makes the following recommendations. First, it is important for the construction industry to take innovation seriously and adopt supply chain management systems and other forms of best practice. Investing in effective systems in the areas of procurement and materials management for the firm is imperative if the firm and the industry are to optimise their supply chains. This would help improve the project management process and result in a more productive workforce. Second, and related to the first recommendation is that construction companies need to look at developing effective construction change management processes, which require an integrated solution, and collaborative project management tools and technologies. Such technologies will go a long way in deepening collaboration with other supply chain partners, including sub-contractors. Third, it is imperative that construction companies develop a culture of continuous improvement. This will

surely require employee training, development and empowerment. Fourth, since the work of construction companies may be affected by factors outside their control, such as inclement weather, it is vital that they have effective time management.

6.   IMPLICATIONS FOR RESEARCH AND PRACTICE

Reflecting on the key findings of the study as discussed above, the following can be implicated for research, practice and society as a whole. Further research is needed to investigate potential improvements in the implementation of project management systems in the construction industry. There is a need to focus on the importance of managing the supply chain outside of the immediate construction site. Future research in this area would be helpful in providing essential guidance and expert advice for construction and logistics managers. Such studies would explore a broad range of strategic and operational responses to the challenges facing the construction industry today, especially the key issues relevant to the management of supply chains within the industry. This study could be extended to other industrial sectors that are critical to the South African economy, such as transport, manufacturing and production.

Insofar as the implications for practice is concerned, the following would be worth considering. First, without a sense of how supply chain strategies can positively affect a company's performance and profitability, the sector will not invest in expensive supply chain systems. Until such time that construction realises that supply chains encompass more than just the buying function, they will not migrate to world class best practice. Second, construction companies appear to have ignored the development in supply chain, resulting in poor overall knowledge and skills within their organisations. Most major players have only commenced with the process of introducing strategic sourcing into their organisations in the past decade. Without a management paradigm shift, strategic sourcing will continue to fail. Third, change management within the construction sector is clearly a problem area and resistance to change is rife in some organisations. This stems from historical practices and management practices which the sector refuses to change.

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