



The Influence of Supply Risk in the Procurement of Construction Materials

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ABSTRACT

The Construction industry is a complex sector that often resists change when confronted with disruptions associated with the procurement of construction materials. Each construction project is unique involving a wide range of parties and activities that cause high market and process fragmentation. This study investigated the influence of supply risk on the procurement function of the construction industry in KwaZulu-Natal, South Africa. A qualitative research design was adopted in this article, employing NVivo 11 for thematic analysis. The study found that supply risks are extremely prevalent with adverse effects on the construction industry, as risk exposure leads to the inability to complete projects on time. The managerial implication and suggestions for further research are discussed in this article.

Key phrases

Construction materials; procurement; supply chain; supply risk

1. INTRODUCTION

The construction industry is a multifaceted industry that is complex and challenged with numerous risks (Ferreira & Kharlamov 2012:1). Construction projects have increased the need for collaboration among the different role players due to a rapid rise in uncertainty, time pressure and complexity (Laedre 2016:689). The industry is notorious for its claims and counter claims, budget overruns, project delays due to supply disruptions which are attributed to underperformance and to low revenue intake (Cheng, Li, Love & Irani 2013:66). This results in imbalance within the supply chain which leads to project delays and excessive costs (Cooper, Grey, Raymond & Walker 2014:228). The construction industry is of vital importance, especially today, where consumer demands have increased when compared to the past. The rise in consumer trends brought about by developments in information technology has increased consumers consciousness in demanding the right product, at the right time, at the right place, and of great quality (Mbachu & Nkado 2017:39). Construction companies are expected to meet these increased demands by ensuring that they have the required components, materials, and parts to satisfy consumer demands. Difficulty in meeting these expectations could have a great impact on organisations who fail to protect against risk (Giado 2012:214). Collaboration is essential for the success of construction projects; the project participants are realising that sharing of knowledge and information is one of the key elements of a successful contractual relationship (Rahman, Endut, Faisol & Paydar 2014:415). Relationships amongst role players can be cut-throat and aggressive. Thus, maintaining customary purchasing procedures could result in disruptions of the procurement process (Eriksson 2015:3). A change of procurement procedures is prompted by a client's habitual behaviour (Potts 2014:219). While purchasing processes require to be tailored to improve the execution of various project objectives, customers tend to choose procurement procedures that they are accustomed to dealing with, irrespective of any

diversions between projects (Rezakhani 2012:4). Disruptions caused by exposure to supply risk disturb the standard course of goods and materials in a supply chain (Agwata, Kwasira & Kihara 2017:10). Such disruptions can have undesirable consequences for the organisation's operations. Supply risks may result in production disruptions; hamper productivity, and capacity utilisation (Mills 2015:245). The construction industry is an important part of the economic backbone of many countries, often accounting for 7-10 percent of the gross domestic product (Okmen & Oztas 2012:204). This study aims to identify supply risks that hinder the procurement function from purchasing the required materials and their effect on the completion of the construction project.

2. REVIEW OF RELATED LITERATURE

This section provides an overview of scholarly articles on the South Africa construction industry. The review of literature provides perspectives on the construction industry supply chain, procurement in construction firms and on the supply chain risks.

2.1 The South African construction industry

In the democratic South Africa, the construction industry has gone through immense change which was a result of development since the Apartheid era when it was controlled by policies stemming from the racial divide and sanction which restricted the industries growth (Huang 2015:347). According to Banaitiene and Banaitis (2013:7), the construction industry is the largest global consumer of resources and raw materials. Minister Gigaba (2015) stated that the government considers the construction sector as part of the country's economic fiber, however the sector is threatened by major delivery challenges, and these challenges stem from procurement challenges. This is evidenced by the increase in financial challenges, complexity and size of the construction projects, the impact of changes in information technology and associated changes in work, and the company's political and social considerations (Gould 2012:11).

Risk originates from the uncertainty which is intrinsic to any construction project. Each risk is related to a cause, and to an effect as well as to the likelihood of the risk event occurring. South African construction projects can be very multifaceted and loaded with uncertainty and

risk (Okmen & Oztas 2012:203). Perry and Hayes (2012:505) stated that risk and uncertainty can potentially have detrimental consequences for construction projects. Risk analysis and management must constantly be featured in the management of construction projects in an effort to deal with uncertainty and unexpected events and in order to deliver projects successfully (Mills 2015:248). The lack of transparency, information sharing, and trust in the construction industry is what makes risk management a crucial but difficult task (Aloini, Dulmi, Mininno & Pastore 2015:496). Risks may include supplier bankruptcy during the project, natural disasters, or political changes that could cause a consequent supply disruption to threaten this sector (Cheng *et al.* 2013:67). While there are standard strategies, construction projects are often developed in remote conditions with geographically distant suppliers where the logistical infrastructure is highly undeveloped (Arantes, Ferreira & Costa 2015:408).

The South African construction industry faces challenges of a struggling rand where the fluctuating value affects the price of construction materials and this affects profitability, this contributes to the skills shortage, and to the reoccurring challenge of collusive tendering in the public sector which prevents fairness in competitively pricing bids from companies and negatively affects the reputation of the industry (Ferreira & Kharlamov 2012:6). South Africa will soon realise an increase in social infrastructure spend by the government in housing, schools and towards the building of roads due to the country's National Development Plan which seeks to bring hope in terms of job creation and economic activity for the sector.

2.2 The construction supply chain

Supply chain management is the key social and economic activity in every country (Arantes, Ferreira & Costa 2015:408). The construction industry is a major contributor to increased Gross Domestic Product (GDP) levels (Bildsten 2016:38). The utilisation of supply chain management processes on the construction industry is vital for construction companies to improve their effectiveness and efficiency in competing with rival firms (Ritchie, Bob & Brindley 2012:303). To organise the supply chain successfully, the company must have knowledge of the work break-down structure, the description of services, logistics, organisations, activities, information, and resources that transform raw materials into finished goods (Sheffi, Yossi & Rice 2012:42).

To acquire a contract to commence a project, the construction company is required to develop a design for the project, and then prepare a tender figure which then needs to be evaluated and approved by the client (Kishan, Bhavsar & Bhatt 2014:834). A construction supply chain requires the integration of multiple disciplines including procurement, scope management, risk management, and quality management in order to build the project to consumer expectations. (Chopra, Sunil & Sodhi 2012:56). The construction project plan must also determine the lifecycle of the project (Zou, Zhang & Wang 2013:5).

The construction industry involves making complex decisions as every building project has different and unique requirements, which require different unique solutions (Hatush & Skitmore 2012:105). Establishing an efficient supplier selection process is of the utmost importance as projects are sometimes developed by a team of suppliers and contractors that have never worked together before which can lead to potentially facing supply risks due to unsatisfactory supplier performance (Stephenson 2016:6). Construction is a spectrum of activities with many complex characteristics and it includes a variety of projects that vary in sizes, types, and specification (Kishan *et al.* 2014:831). A supply chain in the construction industry is not linear and simplex, instead it is complex as the markets and supply chain needs to be integrated into the construction company so that they can meet the requirements of the clients' expectations (Renault & Agumba 2016:3).

2.3 Procurement in the construction industry

Kidd (2012:2) states that procurement is the company's management function that guarantees sourcing, identification, management and access of the materials that the company requires or may require in order to accomplish its objectives. Croux (2016:3) indicated that company's must pursue a strategic approach to purchasing, this improves effectiveness and efficiency in the company's operations as well as increasing profit through effective transactions, cost reductions, sourcing, and standardised purchasing processes. Procurement systems are categorised into traditional and non-traditional systems (Murphy 2013:5). The most utilised method is the traditional method of procurement (Cox 2013:2). Traditional contracting is the separation of design and construction utilising a lump-sum contract (Kearney 2015:5). Traditional contracting has weaknesses, as all other procedures of procurement do, however the construction industry has used it for years and it has

become the most understood method (Ozovehe 2017:6). According to Potts (2014:219), the traditional process is the construction company's ultimate strength - the designer is accountable for design and the contractor for execution, so accountability for management of subcontract packages lies with the contractor. While complications will unavoidably arise, as with any procurement system, the traditional method sees the parties knowing where they stand, and who has responsibility for what (Flanagan, Norman & Chapman 2016:264). Bildsten (2016:38) indicates that the Design and Build method of procurement is a common method that customers choose, as the risk mostly lies with the contractor and the procedure is fairly easy to comprehend. South Africa has established a system of procurement, called targeted procurement to rectify imbalances in business ownership patterns that arose from the apartheid era in the construction sector to enable procurement to be utilised as an instrument of social policy in a quantifiable, auditable, verifiable, and measurable manner (Waterhouse 2015:21). A non-traditional procurement system is a varied contemporary procurement system that does not merely consider construction and design, but also considers operating, facility, and financial management (Mbachu & Nkado 2017:45). Huang (2015:348) state that the non-traditional procurement system is showing signs of being effective in overcoming the hurdles intrinsic within the traditional procurement system. Regardless of the positive qualities related to the non-traditional procurement system, it is still insufficiently refined to permit a conclusion as to what are the correct procurement systems for a building project (Long 2017:6).

According to Renault and Agumba (2016:1), for the customer to attain a constructed building, tenders from procurement systems are requested. Open tendering is a process that permits almost any contractor to submit a tender for the work; this procedure involves either the customer or consultant of the customer placing a public advertisement which gives a short description of the project (Oluchi 2012:4). Selective tendering entails the customer preparing a short-list of contractors that are notorious for having the fitting credentials to carry out the project successfully. Those contractors who wish to be listed are then requested for further information regarding their financial standing, relevant experience, resources at their disposal and technical competence and pre-qualifying contractors who are on the list are invited to tender (Ozovehe 2017:4). The selection of designers is normally

regularly based on a mixture of previous working relations, conceptual design, fees, and track record (Weele 2015:13). Negotiated tendering is applied in numerous contexts; however the crux is that tenders are attained by the customer inviting a single contractor of choice to submit a tender for a project (Mbachu & Nkado 2017:45).

Langkos (2015:8) argues that partnering is the best way of taking on all kinds of construction projects, including refurbishment and maintenance, new buildings and infrastructure, and alterations. Long-term (strategic) partnering commitments show the true benefits of the procurement method, while short-term (project-specific) partnering was also shown to be highly valued on individual projects (Fenson & Edin 2012:11). The principles of partnering comprises mutual objectives, overall improvement in performance, and decision-making procedures (Kennedy 2015:1). Public procurement involves the buying of goods and services by government organisations and is regulated by the *Constitution of the Republic of South Africa Act 1996* (Tucker & Gilfillian 2013:2). The private sector comprises privately run organisations. Although private and public organisations have some procurement similarities, there are vital differences (Eriksson 2015:15).

2.4 Supply chain risks

Today, supply chains are riskier than they have ever been. This is due to the pace of growth and innovation, stronger competition, lean operations, Just In Time (JIT), short product life-cycle, globalisation, fewer vendors, scarce resources, changing demands, advancing technologies, and more stringent requirements (Norrman, Andreas & Jansson 2015:344). There are two sides to supply chain risks; procurement and supply. Procurement risk is defined as the possibility of failures in a procurement process (Harland, Brenchley & Mulde 2013:18). Procurement risk includes; cost, quality, fraud, and delivery (Hatush & Skitmore 2012:106). Kolenko (2016:26) states that risk in procurement is measured from a transactional point of view where risk management is dedicated to things that can go wrong in the procurement process. This transactional point of view is concerned with actions that may contribute towards failure to comply with the required procurement process, inadequacy of the procurement process to achieve the commercial outcome, and a break down in the procurement process (Sim & Pabala 2012:18). Companies OFTEN overlook procurement

decisions, and this may lead to major difficulties in completing the project (Martindale 2015:49).

A construction company faces many challenges, which include discontinuity and disruption in the supply of essential materials, unavoidable increases in project costs and in unit costs of purchased materials, both immediate and long-term loss of power and impact on relationships with essential suppliers, inability to meet customer demand, procurement functions that do not support organisational objectives, factors that weaken a company's ability to respond with speed and agility to meet changing circumstances, opportunity for fraud and corruption during the tendering process, and negative impact on reputation in the market place (Ritchie, Bob & Brindley 2012:304). Fundamental challenges during procurement in the construction industry comprises of external factors such as labour, safety or other laws, nuclear pollution, supersonic bangs damage due to war, government policy on taxes, industrial disputes, and malicious damage to property (Teresa, Blackhurst, Vellayappan & Chidambaram 2015:8). These challenges often give rise to procurement risk in the company (Muelbrook 2012:103). Speculative risk is something which can be allocated in advance as decided by the parties in the contract (Seifbarghy 2014:3). This may involve loss of time and money, as a consequence of exceptionally adverse weather, unforeseeable shortages of labour or materials, unexpected ground conditions, and other similar difficulties beyond the control of the contractor (Zsidisin & Smith 2015:3).

Supplier-related issues that occur during procurement can cause risk for the business. Perry and Hayes (2012:499) states that while supplier issues are a challenge for professionals they cause purchasers the biggest headaches by far. Over 40 percent of purchasers surveyed mentioned supplier issues as their number one challenge, whether it's finding the right suppliers to purchase from or getting them to perform as anticipated. Of all the challenges procurement professionals face with suppliers, finding the right one was considered the greatest challenge (Rezakhani 2012:4). Regardless of whether the company is searching overseas or not, identifying suppliers who could deliver the materials they need according to their specifications was a struggle (Seifbarghy 2014:2). Once they identified the right suppliers, establishing a relationship seems to be a challenge (Vakharia & Yenipazarl 2014:250). According to Willis (2012:2), deciding on the right selection criteria, finding the

relevant supplier information, and collaborating on supplier evaluation were all named as challenges in purchasing. Other common challenges included difficulty in upholding a stable supply while meeting high quality standards and monitoring supplier performance over time (Norman, Andreas & Jansson 2015:434).

According to Zou *et al.* (2013:11), supply risk is defined as the recurrence of significant or disappointing failures with inbound goods. Meulbrook (2012:103) defined supply risk as that which undesirably affect inward flow of any type of resource that inhibits operations from taking place. Materials are required to complete a project, prices of materials may be unstable and the availability of the material for the lifespan of the construction project cannot be assured and this gives rise to supply risks for the company (Vorst & Beulens 2017:411). The degree to which risks are shared among all stakeholders in a construction project is ruled by the procurement strategy selected and by the content of the contract (Temkin 2015:9). Contract conditions often make it a contractual obligation to have insurance cover against these risks (Flanagan, Norman & Chapman 2016:252). Kearney (2015:6) states that although disruptions are inevitable, the procurement function is not equipped to respond. Organisations that can quickly identify diagnose and resolve these problems and issues will be in the best position to survive (Ritchie, Bob & Brindly 2012:305).

Supply chains are one way of addressing major disruptions as managing risks have fallen to the bottom of the list of priorities. Overlooking the importance of managing supply disruptions, places the procurement activities in a vulnerable position in today's weak geopolitical and economic environment (Seifbarghy 2014: 3). Knight (2015:4) says that managing risk is an essential component of effective and efficient management in the construction industry. Companies should guarantee that managing risk is in the performance management plan (Mills 2015:246). Managing supply risk from the early stages of the construction project, where important decisions can be influenced is crucial (Okmen & Oztas 2012:206). The benefits of the risk management process involves identifying and analysing risks, the improvement of construction project management processes, and the effective use of resources (Zaghloul & Hartman 2013:419). According to Abdou (2012:3) managing risks in construction projects has been recognised as an important factor in the process to meet

anticipated construction project objectives in terms of time, cost, quality, safety and environmental sustainability.

3. RESEARCH OBJECTIVES

The article is based on a research project which aimed to determine the challenges faced in the procurement of construction material in South Africa construction industry. The study was guided by the following objectives:

- To explore the prevalence of supply risks in the procurement of construction materials:
and
- To examine the impact of supply risks on the procurement of construction materials.

4. METHODOLOGY

This study employed a qualitative approach to achieve the objectives of study. In a study of this nature, expert opinions on the subject matter of investigation are sacrosanct. A qualitative approach was found appropriate to be able to gather detailed relevant information about the construction industry in KwaZulu-Natal, South Africa (Sutton 2015:196). Adopting a qualitative approach presented an avenue to explore the supply risks in the procurement of construction materials and the effect on the supply chain. This justified the adoption of purposive sampling, a type of non-probability sampling technique to select experts in the construction industry in KwaZulu-Natal with sound knowledge in procuring construction materials.

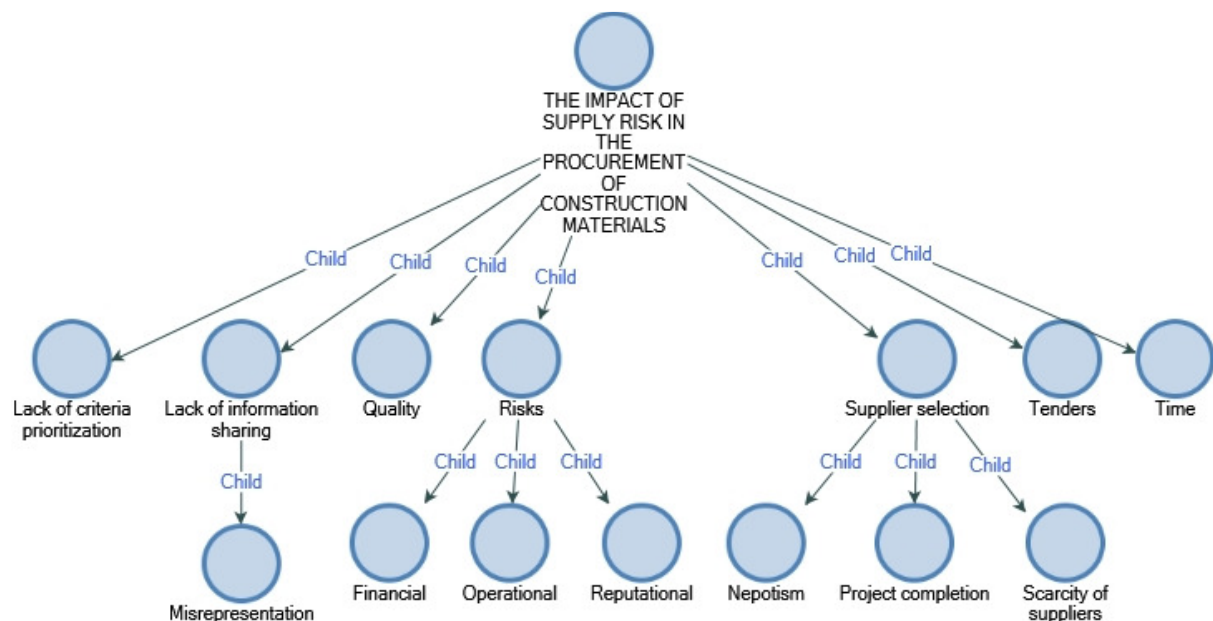
The study was conducted in Durban, in the province of KwaZulu-Natal in South Africa. Samples were drawn from two construction firms located in the Durban Metropolitan Area. The difference between the firms sampled was that one falls in the category of small, medium and micro-enterprise (SMME), while the other is a large enterprise. The SMME is only engaged in private projects, while the large enterprise does private and government projects. The dichotomy enabled the researchers to compare data between a small enterprise where the owner is more likely to be involved in all aspect of the business, and a large enterprise where purchasing is separated from the other operations. The Chief

operating officer of the SMME category and the procurement manager of large enterprise were purposively selected for interviews.

5. RESULTS AND DISCUSSION

This study investigated the impact of supply risk in the procurement of construction materials in KwaZulu-Natal, South Africa. The major themes that emerged from the qualitative data collected on the impact of supply risks on the procurement of construction materials includes lack of criteria prioritisation, lack of information sharing and problems regarding quality, risks, supplier selection, tenders and time. Figure 1 represents and makes use of the word ‘*child*’ as a requirement label generated by NVivo 11 software and does not have any significant implication.

Figure 1: Supply risk in the procurement of construction materials



Source: Researchers own

Throughout the participants interviews it was evident that time was a priority and that supply risk and time are positively correlated. Delay of materials to the construction project site increases the timeline for completing the project, thus having a direct impact on profit as

additional funds will need to be utilised to acquire the supply to site on time. Speeding up transportation incurs additional cost and waiting until the materials are replaced results in waste.

Various statements from the interviewees highlight just how significantly nepotism may negatively affect the outcome of projects and results in supply challenges faced by the construction company. Suppliers selected based on friendship are potentially incompetent in producing materials that meet the requirements of the projects. The supplier may deliver the materials late which will result in the delay of the project, or the supplier could undercut costs and deliver materials of inferior quality which will impact negatively on the company's reputation.

When interviewees were asked if location is a key factor in selecting suppliers, it was found that companies neglect the importance of determining whether or not suppliers are available in their region when accepting a tender bid. This has a major effect on supply risk as there may be no supplier available to supply the materials for the project. The company will have to spend large amounts of money on suppliers from abroad or from a location that is not best positioned, thus the company is then subjected to long lead time.

Interviewees did not prioritise their material procurement. Prioritising purchasing decisions into categories makes purchasing more efficient and can minimise supply risk. The lack of criteria prioritisation can affect the outcome of the project. Material categories determine the type of relationship to form with a supplier. An empirical study conducted by Safa, Shahi, Haas and Hipel (2014:64) revealed that the complex global market has resulted in a robust mechanism, which covers all facets of material procurement. When the procurer categorises items and undertakes different strategies based on those items this could ensure a continuous flow of supply until the project is complete (Safa et al. 2014:69).

Respondents emphasised that lack of information-sharing creates major problems in the completion of projects. Lack of information causes misinterpretation as suppliers present little information to win the tender thus leading the construction company to make assumptions about unclear information. Information such as delivery and quality. When the materials do not meet the requirements of the project, the construction company will have to spend additional time and money to get new materials increasing costs and project delays.

Suppliers may not disclose their work load as they will want to win the tender and may fail to deliver materials on time as their schedules are not efficient.

From the interview responses, it appears that risks can be divided into three categories; financial, reputational, and operational. Interviewees were clear in stating that the depth of supply risk has an effect on these aspects which are interlinked and interdependent on each other.

Interviewees indicated that poor quality is directly linked to supply risk. Should the company select a supplier that is incompetent and who produces materials that are defective, this would delay project completion as the company will have to wait for materials that meet the standards of the project being built.

The interviewees spoke a lot of how, when undertaking tenders, companies' often cut their prices and minimises costs so that the government or private companies award the company the tender. This has a direct impact on supply risk as quality is often lowered which will result in defective materials. Selecting incompetent suppliers who cannot deliver materials that meet the requirements of the project increases supply risk (Chin, Tat & Sulaiman 2015:675; Yan, Chien & Yang 2016:4).

6. LIMITATION AND DIRECTION FOR FUTURE RESEARCH

This study is limited to the province of KwaZulu-Natal, South Africa employing a qualitative approach for data collection and analysis. There is a need to conduct a similar study in other provinces in South Africa using a mixed methods research design. In addition, the adopting of purposive sampling technique requires the need to conduct a similar study, which will employ other forms of data gathering to validate the findings of this study.

7. RECOMMENDATION

To prevent risks due to time, the contractor ought to create contract provisions and project processes to create a clear expectation of the temporal requirements for planning, producing, and managing the project. There is a need for the contractor to develop a claims avoidance and mitigation system to help in the resolve of possible disagreements especially those involving schedule and cost overruns. A smart claims avoidance and mitigation

program includes: reviewing contract documents to find possible risk areas and understanding how they can be managed and resolved, ensuring that crucial claims avoidance provisions and procedures are included in the contract documents; preparing staff for established processes for the areas in which claims are prone to arise; developing an initial warning system; establishing a steady response to potential claims, and recommending techniques to avoid, identify, analyse, mitigate, and resolve claims; periodically establishing the value of the avoidance and dispute resolution procedure through a claims surveillance program; notifying management and the project team via a periodic reporting system; guaranteeing that everyone is in agreement with the plans, actions, timeline, and results being produced; and understanding of the advantages and disadvantages of the project delivery system used, as well as the obligations, roles, and responsibilities accepted or rejected by the involved parties.

The contractor ought to create an awareness of the important contract provisions that could cause disagreements, delays, and cost overruns. The contractor should create and maintain a summary entitlement analysis using scheduling software that holds each supplier responsible for their task. A flexible schedule should be developed where all parties involved are able to meet scheduled dates without delays.

A vital stage in the supplier management process is establishing an audit and assessment program. The article recommends that the contractor should always conduct due diligence before the contract is signed to check that the supplier does not have any major compliance or quality system failures that could affect the company's ability to build top-quality projects. Another reason to do an audit in advance is to comprehend the supplier's strengths and weaknesses before the relationship becomes official. Even after the contract is signed, the contractor should continue auditing, basing the occurrence of the audits on the reputation of the supplier. To determine the frequency, all suppliers should be grouped according to the level of risk or importance. This arrangement will aid the contractor to be smarter and more effective with the materials and place a greater focus on the important, high-risk suppliers, while continuing to monitor second-tier suppliers. Beyond an established audit program, the contractor ought to monitor and evaluate each supplier's performance. Through this, contractors can track positive or sustained strong performances, as well as negative trends.

8. CONCLUSION

This article contributes to existing literature on purchasing and supply management. The practical implication of the study is drawn from the analysed data. Construction companies can minimise or mitigate supply risks through, better time management, improved supplier selection strategies applied to the increasing suppliers in the country. Criteria prioritisation, information-sharing, selecting vendors in different geographic regions who supply through secondary ports, quality assurance, quality control, a risk management plan, and efficient tendering processes. Construction companies may use the recommendations to help counteract supply risk and make their procurement operations more proficient.

REFERENCES

- ABDOU OA.** 2012. Managing construction risks. 3rd edition. *Journal of Architectural Engineering* 2(5): 3-10.
- AGWATA, KWASIRA & KIHARA.** 2017. Application of procurement best practices in enhancing service delivery in Oil Refinery in Nakuru, Kenya. [Internet:<http://ijecm.co.uk/wp-content/uploads/2017/05/5524.pdf>; downloaded on 20 April 2017]. (pp 10-22.)
- ALOINI D, DULMI R, MININNO V & PASTORE M.** 2015. Risk management in construction supply chain: A Review and Analysis of the Literature. Lappeenranta. (IPSERA). (19th edition, pp 494-504.)
- ARANTES A, FERREIRA LMD & COSTA AA.** 2015. Is the construction industry aware of supply chain management? The Portuguese contractors' perspective. *Supply Chain Management: An International Journal* 20(4):404-414
- BANAITIENE & BANATIS.** 2013. Risk management in construction projects. [Internet:<http://web.mit.edu/jsterman/www/SDG/project.pdf>; downloaded on 25 July 2017]. (pp 6-10.)
- BILDSTEN L.** 2016. Purchasing in construction companies. 1st edition. Lund, Sweden: Media-Tryck. (Lund University, pp 35-42.)
- CHENG E, Li H, LOVE P & IRAN Z.** 2013. An E-Business 14th edition. Model to support supply chain activities in construction. *Logistics information management* 66-78.
- CHIN TA, TAT HH & SULAIMAN Z.** 2015. Green supply chain management, environmental collaboration and sustainability performance. *Procedia CIRP* 26:695-699.
- CHOPRA, SUNIL & MANMOHAN SS.** 2012. Managing risk to avoid supply-chain breakdown. *MITSloan Management Review* 46(1):53-61. [Internet:<http://sloanreview.mit.edu/the-magazine/2004-fall/46109/managing-risk-to-avoid-supplychainbreakdown/>; downloaded on 25 August 2017.]
- COOPER D, GREY S, RAYMOND G & WALKER P.** 2014. Project risk management guidelines: managing risk in large projects and complex procurements. [Internet:<http://www.broadleaf.com.au/publications/books.html>; downloaded on 27 July 2017.] (pp 225-381.)

COX A. 2013. Understanding buyer and supplier power: A framework for procurement and supply competence. 2nd edition. *Journal of Supply Chain Management* 8-15.

CROUX E. 2016. Purchasing must become supply selling: How managers can guard against materials disruptions by formulating a strategy for supply. [Internet:<https://www.vlerick.com/~media/Corporate/Pdf-general/Kraljic%20Matrix%20of%20Procurement%2020022015%20pdf.pdf>; downloaded on 01 June 2017]. (pp 1-4.)

ERIKSSON. 2015. Effects of procurement on construction project performance. [Internet:<https://www.diva-portal.org/smash/get/diva2:1011258/FULLTEXT01.pdf>; downloaded on 20 September 2017]. (pp 1-19.)

FENSON & EDIN. 2012 How purchasing practitioners use the Kraljic Matrix a relative comparative case study with four big Swedish industrial manufacturing companies. [Internet:<http://arc.hhs.se/download.aspx?MediumId=537>; downloaded on 24 August 2017]. (pp 8-21.)

FERREIRA & KHARIAMOV. 2012. Application of Kraljic's Purchasing Portfolio Matrix in construction industry - A case study. [Internet:http://www.abepro.org.br/biblioteca/icieom2012_submission_111.pdf; downloaded on 05 July 2017]. (pp 1-11.)

FLANAGAN R, NORMAN G & CHAPMAN R. 2016. Risk management and construction. 2nd edition. Oxford: Blackwell Pub. (pp 251-300.)

GIADO KJ. 2012. Project complexity: The focal point of construction production planning. *Construction Management and Economics* 14:213-225.

GIGABA M. 2015. Construction sector faces many challenges. [Internet:<http://www.sanews.gov.za/south-africa/construction-sector-faces-many-challenges-gigaba>; downloaded on 04 July 2017.]

GOULD. 2012. Factors affecting timely completion of construction projects. [Internet:https://www.researchgate.net/publication/266878915_factors_affecting_timely_completion_of_constructi_on_projects; downloaded on 28 September 2017]. (pp 1-12.)

HARLAND C, BRENCHLEY R & MULDE H. 2013. Risk in supply networks. [Internet:https://www.researchgate.net/publication/223757629_Risk_in_Supply_Networks; downloaded on 21 June 2017]. (pp 18-25.)

HATUSH Z & SKITMORE M. 2012. Contractor selection using multicriteria utility theory: An additive model. *Building and Environment* 33:105-115.

HUANG. 2015. Supply chains in the construction industry. [Internet:<http://www.emeraldinsight.com/doi/full/10.1108/13598541011068260>; downloaded on 10 April 2017]. (pp 347-353.)

KEARNEY. 2015. Is Your Luck Running Out? Managing Supply Risk in Uncertain Times. [Internet:<https://www.atkearney.com/documents/10192/7911127/Is+Your+Luck+Running+Out-Managing+Supply+Risk+in+Uncertain+Times.pdf>; downloaded on 13 June 2017]. (pp 1-12.)

KENNEDY M. 2015. A guide to interviews. [Internet:<https://msu.edu/user/mkennedy/digitaladvisor/Research/interviewing.htm>; downloaded on 16 June 2017]. (pp 1-5.)

- KIDD A.** 2012. The definition of procurement. [Internet:https://www.cips.org/Documents/CIPSAWhiteArticles/2006/Definition_of_Procurement.pdf; downloaded on 04 July 2017]. (pp 1-8.)
- KISHAN P, BHAVSAR JJ & BHATT R.** 2014. A study of risk factors affecting building construction projects. *International Journal of Engineering Research & Technology* 3(12):831-835.
- KOLENKO S.** 2016. Supply chain management. [Internet:<https://www.crs.org/sites/default/files/crs-files/institutional-strengthening-7-supply-chain-management.pdf>; downloaded on 13 May 2017]. (pp 23-42.)
- LAEDRE O.** 2016. Procurement routes in public building and construction projects. *Journal of Construction Engineering and Management* 132(7):689-696.
- LANGKOS S.** 2015. Research methodology and data collection tools. [Internet:https://repository.nwu.ac.za/bitstream/handle/10394/11070/Coetsee_AJ_Chapter_4.pdf?sequence=5; downloaded on 02 August 2017]. (pp 5-27.)
- LONG** 2017. Construction claims prevention. [Internet:http://www.long-intl.com/articles/Long_Intl_Construction_Claims_Prevention.pdf; downloaded on 20 September]. (pp 2-16.)
- MARTINDALE N.** 2015. Rising risks in supply chain. [Internet:[http://www.scrlic.com/articles/Supply_Chain_Risk_Management_A_Compilation_of_Best_Practices\[1\].pdf](http://www.scrlic.com/articles/Supply_Chain_Risk_Management_A_Compilation_of_Best_Practices[1].pdf); downloaded on 21 June 2017]. (pp 47-55.)
- MBACHU J & NKADO R.** 2017. Factors constraining successful building project implementation in South Africa. *Construction Management Economics* 25(1):39-54.
- MILLS A.** 2015. A systematic approach to risk management for construction. *Study Survey* 19(5):245-252.
- MUELBROOK.** 2012. Managing risk in virtual enterprise networks: implementing supply chain strategy. [Internet:<https://books.google.co.za/books?id=Sh-SgAyhKbQC&pg=PA101&dq=>; downloaded on 22 June 2017]. (pp 101-109.)
- MURPHY.** 2013. Strengths and weaknesses of descriptive research. [Internet:<http://files.eric.ed.gov/fulltext/EJ1066917.pdf>; downloaded on 15 August 2017]. (pp 4-10.)
- NORRMAN, ANDREAS & JANSSON.** 2015. Ericsson's proactive supply chain risk management approach after a serious sub-supplier accident. *International Journal of Physical Distribution and Logistics Management* 34:434-456.
- OKMEN O & OZTAS A.** 2012. Construction cost analysis under uncertainty with correlated cost risk analysis mode. *Construction Management Economics* 28(2):203-212.
- OLUCHI N.** 2012. Project Prioritisation. [Internet:https://oqi.wisc.edu/resource/library/uploads/resources/Project_Prioritisation_Guide_v_1.pdf; downloaded on 01 June 2017]. (pp1-8.)
- OZOVEHE E.** 2017. The Definition of Procurement. [Internet:<https://www.bayt.com/en/specialties/q/345826/what-is-the-difference-between-strategic-procurement-tactical-procurement-and-operational-procurement/>; downloaded on 01 June 2017]. (pp 3-8.)
- PERRY JH & HAYES RW.** 2012. Risk and Its Management in Construction Projects. Proceedings of the Institution of Civil Engineering. (Part I 78:499-521.)

- POTTS K.** 2014. Construction Cost Management. [Internet:<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.475.4159&rep=rep1&type=pdf>; downloaded on 01 June 2017]. (pp 218-225.)
- RAHMAN SHA, ENDUT IR, FAISOL N & PAYDAR S.** 2014. The Importance of Collaboration in Construction Industry from Contractors' Perspectives. *Procedia: Social and Behaviour Sciences* 129.
- RENAULT BY & AGUMBA JN.** 2016. Risk Management in The Construction Industry: A New Literature Review. 1st edition. (pp 1-4.)
- REZAKHANI P.** 2012. Classifying Key Risk Factors in Construction Projects. [Internet:<http://bipcons.ce.tuiasi.ro/Archive/292.pdf>; downloaded on 24 July 2017]. (pp 4-8.)
- RITCHIE B & BRINDLEY C.** 2007. Supply chain risk management and performance: A guiding framework for future development. *International Journal of Operations and Production Management* 27(3): 303-322.
- SAFA M, SHAHI A, HAAS CT & HIPEL KW.** 2014. Supplier selection process in an integrated construction materials management model. *Automation in Construction* 48:64-73.
- SEIFBARGHY M.** 2014. Measurement of Supply Risk and Determining Supply Strategy. 40th edition. (pp 1-5.)
- SHEFFI, YOSSI & JAMES B RICE JR.** 2012. A Supply Chain View of the Resilient Enterprise. *MITSloan Management Review* 47(1). [Internet:<http://sloanreview.mit.edu/the-magazine/2005-fall/47110/a-supply-chain-view-of-the-resiliententerprise/>; downloaded on 04 July 2017]. (Fall 2005, pp 41-48.)
- SIM B & PABALA L.** 2012. Reconceptualizing the Determinants of Risk Behavior. *The Academy of Management Review* 15-21. [Internet:http://www.jstor.org/stable/258646?seq=1#page_scan_tab_contents; downloaded on 20 June 2017.]
- STEPHENSON SG.** 2016. Supply Chain Risk and Reward Measuring Risk In Your Supply Chain. [Internet:<http://www.apics.org/docs/default-source/industry-content/supply-chain-risk-and-reward-measuring-risk-in-your-supply-chain.pdf?sfvrsn=0>; downloaded on 04 August 2017]. (pp 5-10.)
- SUTTON J.** 2016. Use of Qualitative Research Techniques in Research. [Internet:<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1496926/>; downloaded on 08 September 2017]. (pp 195-199.)
- TEMKIN.** 2015. An Overview of the Construction Industry. [Internet:www.springer.com/cda/content/document/cda.../9789812872623-c2.pdf?sgwid...; downloaded on 04 July 2017]. (p 9.)
- TERESA, BLACKHURST B & VELLAYAPPAN C.** 2015. A Model for Inbound Supply Risk Analysis. [Internet:<https://pdfs.semanticscholar.org/f860/e4966b88de018b32d4cdae87a7ba7efc2561.pdf>; downloaded on 14 June 2017]. (pp 1-16.)
- TUCKER & GILFILLIAN.** 2013. Public Procurement in South Africa: Overview. [Internet:<http://www.bowmanslaw.com/article-documents/Public-Procurement-in-South-Africa.pdf>; downloaded on 20 August 2017]. (pp 1-12.)
- VAKHARIA & YENIPAZARL.** 2014. Managing Supply Chain Disruptions. [Internet:http://warrington.ufl.edu/departments/isom/docs/vakharia/2009_fttiom.pdf; downloaded on 21 July 2017]. (pp 250-255.)

- VORST & BEULENS.** 2017. Identifying Sources of Uncertainty to Generate Supply Chain Redesign Strategies. [Internet:<http://www.emeraldinsight.com/doi/abs/10.1108/09600030210437951>; downloaded on 22 March 2017]. (pp 409-430.)
- WATERHOUSE J.** 2015. An Introduction to Concepts and Issued by John R. Weeks. A College Textbook and a Good Introduction to Population Issues, Including Terms and Definitions. 12th edition. (pp 20-27.)
- WEELE A.** 2015. Purchasing and Supply Chain Management. 4th edition. Thomson: London. (pp 12-18.)
- YAN MR, CHIEN KM & YANG TN.**2016. Green component procurement collaboration for improving supply chain management in the high technology industries: A case study from the systems perspective. *Sustainability* 8(2):1-16.
- ZAGHLOUL R & HARTMAN F.** 2013. Construction contracts: The cost of mistrust. *International Journal of Project Management* 21(6):419-424.
- ZSIDISIN G & SMITH M.** 2015. Managing supply risk with early supplier involvement: A case study and research propositions. [Internet:http://iew.technion.ac.il/msom2015/msom.technion.ac.il/conf_program/articles/TA/5/221.pdf; downloaded on 18 June 2017]. (pp 3-5.)
- ZOU PXW, ZHANG G &WANG J.** 2013. Identifying Key Risks in Construction Projects: Life Cycle and Stakeholder Perspectives. [Internet:https://www.researchgate.net/publication/237402455_identifying_key_risks_in_constuction_projects_life_cycle_and_stakeholder_perspectives; downloaded on 20 June 2017]. (pp 1-15.)