

EXPLORING 'LEAN' OPPORTUNITIES FOR IMPROVING SUPPLY CHAIN TRANSACTION GOVERNANCE IN SOUTH AFRICAN CONSTRUCTION PROJECTS

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ABSTRACT

Transaction governance dictates how members of a construction supply chain (SC) work together for the delivery of a project. This practice is the same in South Africa where many problems have stalled the achievement of expected value for the client. In an attempt to understand the problem better, an exploratory study that assessed 'how do transaction governance structures between SC members affect project delivery in South African construction' was conducted in 2015.

Using a single case study research design that was underpinned by the review of relevant literature as a starting point, it was observed that project parties in the case project have not moved away from the practice where the contract data form the basis of interaction among them. The study shows that optimum risk allocation approach that is evident in profit / reward sharing and collaboration is hindered by traditional view of transaction governance that is plagued with mutual distrust and antagonism. In other words, there appears to be a major scope for the introduction of integrated (lean) project delivery method that will foster collaboration and a culture of teamwork that favours improved project performance in South Africa.

KEYWORDS

Construction, Governance, Supply Chain, South Africa

INTRODUCTION

Reports in the last few decades indicate that the construction industry is failing to deliver as expected in terms of expected socio-economic gains due to problems in which the contributions of fragmentation is notable. Fragmentation in supply chains may result in financial problems, operational capital problems, delayed payment from clients, substandard designs and specifications, lack of technical proficiency, poor

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information sharing among supply chain members, production ineptitudes, poor work quality, work method issues, and project delivery reliability issues (Benton and McHenry, 2010).

For example, despite significant investments, promising construction projects often produce enormous wasted time and finance (Forbes and Ahmed, 2010). This underlines the rationale for the industry to change. Close to home, the construction industry lacks innovation or “out-of-the-box thinking” in South Africa (Rust and Koen, 2011). However, general construction problems are not limited to South Africa: the construction industry is facing challenges in developing economies (Ofori, 2012).

The world has adapted to tackling these issues through supply chain management (SCM), integrated project delivery (IPD) and building information models (BIM). To tackle the effects of division and adversarial relations, researchers and other experts in the construction industry have shifted their focus to SCM for the purpose of making the industry more efficient (Khalfan et al., 2004). SCM is applied to logistics, supply, manufacturing, and distribution needs in construction from a technological standpoint, which involves BIM (Dong et al., 2013). The successful aspects of integrated collaboration using BIM can be categorized as product information sharing, governmental roles interaction, and production activities coordination, conditions for teamwork and reference data-merging (Khalfan et al., 2015).

However, in South Africa, the use of technology is not adequate for improved performance because of the multiplicity of work culture in the industry (Emuze and James, 2013). This implies that better responsibility amongst all members within the industry needs to be the norm. Friendship has to be built between SCM members for collaborative information sharing and lasting partnerships. This research therefore explored the impact of transaction governance structure (TGS) on the management of supply chains by asking ‘how do transaction governance structures between supply chain members affect project delivery in South African construction’. This is premised on the view that project processes require effective governance in order to deliver value to clients (Winch and Carr, 2001).

The paper provides an overview of TGS by highlighting what it is by showing the role it plays in an economic system. Thereafter, the method of the study is presented before results of face-to-face interviews are discussed. The paper closes with further discussions on how to take the research forward in South Africa.

AN OVERVIEW OF TRANSACTION GOVERNANCE

Research in construction supply chains using IPD principles has aided in the completion of high performance projects through the creation of a collaborative system; which can be used to address traditional construction procurement issues (Akintan and Morledge, 2013). The construction industry is currently specialized to such a degree that no single firm is capable of providing all the specialized expertise needed; thus there are numerous firms focusing on different disciplines to meet varied and complex demands. Therefore, understanding what TGS is and its role in the industry is important in practice.

What are transaction governance structures?

TGS is defined as the legitimate systems of governance that apply to various types of transactions and the organizational and administrative precautions that parties assign to a transaction (Ring and van de Ven cited in Zhang, 2006). A TGS is created

during each society's evolution. It has a distinctive blend of market, social and legal attributes, which has influenced studies on it move from traditional competitive, "arm's length", buyer-supplier relationships towards longer-term, more complacent relationships where buyers and suppliers view one another as partners. The movement is taking place because the essence of partnership is a commitment to a collaborative exchange where parties mutually share project risks and opportunities (Patterson et al., 1999).

Transaction cost economics (TCE) is an essential anchor for studying an extensive series of economic and organizational problems (Zhang, 2006). TCE framework governs exchange of goods and services among technologically separable interfaces based on two assumptions: resourcefulness and confined rationality (Williamson, 1979, Williamson, 1981). The basic insight of TCE is that in order to economize on the total cost of a service, production costs and transaction costs have should be aggregated (Winch, 2001). Winch (2001) noted that TCE focused on understanding the drivers of transaction costs. The elaborate transaction governance framework in Winch (2001) shows how the right choices of transaction governance mode are affected by three contingency factors (uncertainty, frequency and asset specificity). These contingency factors interact with each other. As an illustration, the absence of uncertainty would allow contracts to negate opportunistic behaviour that may arise from asset specificity (Winch, 2001). When asset specificity is removed from a setting, negotiations to handle unforeseen events can proceed when they occur; and frequency determines the return from investing in transaction-specific modes. However, differences in institutional context often shift the interactive space between these contingency factors (Winch, 2001).

What is the role of TGS in a supply chain?

TCE centres on the body of transactions that take place each time a good or service is transferred within a supply chain. When transactions are domestic, costs implied by such transaction consists of managing and coordinating personnel and acquiring contributions and capital equipment. Similar to the norm in construction, the transaction costs of purchasing the identical good or service from an outside supplier can consist of source selection (bid process), contract administration, performance evaluation, and dispute resolution, as a result, TGS have an influence on transaction costs (Williamson, 1979, Williamson, 1981).

However, TGS is deviating from hierarchical (vertical) integration to a greater amount of outsourcing. It is diverting from self-ruling market rivalries to partnerships. The deviation is against the backdrop of outsourcing, which is one of the principal requirements for integrated SCM in construction (Benton and McHenry, 2010). This, however, poses its own set of questions: single versus multiple sources. The principal advantage of multiple sourcing is the creation of a competitive supply base. It is generally accepted that competition has a direct correlation with driving costs down. The other factor is that multiple supply sources assure undisrupted stream of material. The principal advantage of single-sourcing is that the supplier is more comfortable with reducing the cost per unit; another benefit is cooperation and communication which leads to win-win relationships among buyers and suppliers.

The time requirement and the comprehensiveness of contracts is another aspect of TGS. An all-inclusive and enforceable contract is challenging to compose, particularly when the intent of the transaction is complex. If contracts are intrinsically

imperfect, parties might notice possible gains from unprincipled conduct, even in a construction enterprise (Pryke, 2012). Therefore, care must be devoted to more diverse governance devices so that gaps in agreements could be bridged, and conflicts could be resolved in unexpected situations (Zhang et al., 2004). Clear management of TGS involve negotiation and multi-dimensional communication among members to accomplish integration of monetary undertakings that are cooperatively held and to address problems that cannot be supervised through autonomous activities or implicit coordination. Implicit coordination takes place when a company activity is spotted, predictable, and matched with activities of other companies (Zhang et al., 2004).

METHODOLOGY

The study aimed to understand the relationship between TGS in the supply chain and project performance in South Africa. To comprehend the issues around the aim, a case study was conducted in Bloemfontein in South Africa. The project involves the construction of an outdoor cafeteria, consisting of two adjacent vendor stations with a covered seating area in the centre. A qualitative research method is often used for SCM research in construction (Tennant and Fernie, 2012a, Tennant and Fernie, 2012b). This is also evident in the SCM papers that have been dissemination within the IGLC community (Emuze, 2015). Such case studies, similar to this study, often try to emphasise the understandings within supply chains by focusing on decisions, interactions and actions of different actors. Thus, the method is arguably well placed to illuminate the actions of actors, and their functions regarding TGS in the supply chain (Yin, 2013). Amongst the various data collection methods used in case studies, the face-to-face technique was used in this study that was conducted in August 2015. However, the use of a single data collection method among the many known methods in case studies is a clear limitation of this research.

Nevertheless, all interviews were tape recorded, transcribed and entered into field notes where necessary. The selection of the participants was unstructured but focused on the SCM team in the selected project. While ten members of the SCM team of the project agreed to participate in the interviews, there was only opportunity to conduct six interviews with two quantity surveyors, one principal agent, one contractor, and two professionals working for the client. The total number of interviews was therefore six, which made the data collection somewhat less rigorous. However, since in qualitative studies, interviews range from 5 to 25 in number (Yin, 2013), a decision to proceed with data analysis was made by the researchers. Rather than generalising into a population sample, the aim of the study is to explore and if possible attempt analytic generalisation (Flyvbjerg, 2006). In demographic terms, the interviewees were all university graduates that are exposed to business and project aspects of construction management. One of the interviewees, who hold a director position in a quantity surveying consultancy and a PhD degree, has been in the industry for over 40 years. The junior quantity surveyor that was interviewed has been in the industry for four years. He holds an honours' degree in quantity surveying. The interviewed principal agent has been in the industry for over 20 years and he holds a masters' degree in Architecture. The acting deputy facilities manager that was interviewed has been in the industry for 16 years. He holds a bachelor's degree in Building. The assistant facilities manager however has four years of industry experience. The interviewed

Site Agent has over 12 years of industry experience. He holds a National Diploma qualification in Building.

The interview protocol was semi-structured with open ended questions. Section one enquires about demographic information while section two addressed the research questions of the study. The use of such semi-structured protocol is suitable because it unfolds in a conversational way that offers interviewees the chance to explore issues based from their experiences (Longhurst, 2009). The collected interview data were examined by focusing on the central question of the study in terms of the approach to the representation of data.

RESULTANT TEXTUAL DATA

The central research question guided the six interviews. Despite the guidance, the interviews were unstructured so that the interviewees could freely elaborate on each questions based on their knowledge and experiences. As a start in each interview, descriptions of SCM and TGS were made to focus the discussions. Broad questions of the interviews are used to present the analysed data as follows.

Question 1: How is transaction governance structured within your company?

Question one focuses on the channels through which transactions amongst parties flow from the top tier of management to the lowest tier in the organisation structure of the project. The question was asked in order to gain a better understanding of how the SCM members interact with one another and how these interactions are governed. For instance, the client used a predetermined internal policy that guides the supply chain team on how consultants and contractors are appointed and governed as shown in Table 1.

Table 1: Observed procurement structure of the client in the case study

Estimated value	Procurement Method	Authorization
<R 10 000	One quotation from preferred 'supplier' list	Deputy Director of Facilities Management
R10 001- R 100 000	Two quotations from preferred 'supplier' list	Deputy Director of Facilities Management
R 100 000 – R 500 000	Three quotations from preferred 'supplier' list	Deputy Director of Facilities Management, with approval from the Director of Facilities Management
>R 500 000	Selected tender procedure from preferred 'supplier' list	Deputy Director of Facilities Management, with approval from the Director of Facilities Management and Deputy Vice-Chancellor

This system does not apply to appointments only, but also it applies to payment certificate approvals. This internal policy determines the way in which parties within the client organisation interact with one another. During construction projects, this policy and the Joint Building Contracts Committee (JBCC) principal agreement govern exchanges amongst the client, consultants, and the contractor. The contractor's system was interesting as the site manager is in complete control of all transactions on site. For example, he appoints suppliers, approves payments, and is the only channel of communication. This observation aligns with the JBCC principal agreement, which explain that all transactions related to subcontractor work flows through the contractor. The quantity surveying (estimator) firm policy follows a standard two-tier

organisational structure that is governed by employer-employee policy in conjunction with the principal ethical and professional standards laid out by the Association of South African Quantity Surveyors (ASAQS). For example, estimate format, and standard system of measuring builders' work follow the ASAQS guidelines. These professional guidelines are augmented with standard documents to help monitor employees in completing their obligations, which are the standard system of measuring builders' work, standard preambles to trades, and the elemental guide to estimating builders' work. The policy directs the internal transactions of the firm, and also governs interactions with external parties through the use of the quantity surveying - client agreement. The architectural firm, however, has no formal policy, which governs its internal interactions; instead it has what is called an 'open door' policy. There was no mention of whether an architect - client agreement is used to govern external transactions; instead the interviewed architect stated that the JBCC principal agreement was the TGS followed.

Question 2: How does this structure affect/influence your supply chain?

This question focuses on how the individual system of each member of the supply chain in the project impacts the success of the team. The majority of the interviewees stated that the TGS employed has a positive impact on the supply chain. The JBCC principal agreement is the main contract that guides all transactions in the project. The JBCC gives a detailed description to what has to be done by each party, how much it costs, when and who receives payment; and how and where it must be done in order to deliver a complete project on time and within budget. This positive response of the interviewees is mainly based on enforcement / compliance to the terms of the contract document as opposed to collaboration / partnership.

Question 3: How would you describe the relationship between transaction governance structure and integrated project delivery?

This question focuses on how the TGS provides a basis for an integrated delivery system. The majority of the interviewees had a negative view on the IPD system. All of them, who are operating under the current procurement system, were of the opinion that the tendering system has no room to cater for the integration of contractor in the early stages of the contract. The contractor, however, expressed enthusiasm for the idea. The quantity surveyors stated that South African contractors lack the knowledge to manage a site properly without 'checks and balances', which makes the client vulnerable to risks. The quantity surveyor, however, recognized that the JBCC principal agreement is structured in such a way that risk is placed with the parties who should be responsible for the risk. None of the interviewees were able to answer this question in a robust and insightful manner, but enough information was obtained to draw a conclusion.

Question 4: How have different technological tools improved team decisions and overall project delivery?

The question focuses on how technological advances have improved project delivery. Most of the interviewees stated that technology has made construction progress faster, as all supply chain members are available at the click of a button. The most popular technological advancement mentioned is the email. The interviewed architect stated that Revit and AutoCAD programs have revolutionise the design process as it easier to make changes to construction drawings. Revit's three-dimensional rendering has made it easier for the client and end-user to visualize the proposed building. The

quantity surveyors stated that Dimension X program has made measuring much easier and quicker.

Question 5: Who has the inputs into the project decisions?

This question focuses on who are the major decision makers within the project. All the interviewees stated that the majority of the decisions are made jointly by all the supply chain members, but all decisions that affect the contract price and delivery date must be approved by the client through the principal agent.

DISCUSSION

The central question of the study tends towards two objectives that are used to discuss the findings of the study in this section as shown below:

Objective 1: Establish transaction governance structures

Based on the responses provided during the interviews, the TGS utilized in the case project can be described as a framework of rules and regulations, which are recognized by law and relevant professional bodies in South Africa. The framework dictates how supply chain partners within an agreement interact. In construction, the interactions between parties of the agreement are often controlled through a set of terms and conditions set up within the contractual agreement. The most preferred contractual document used in South African construction is the JBCC principal agreement (Othman and Harinarain, 2009, Richards et al., 2005). However, the JBCC does not cater for the establishment of a collaborative working arrangement that is aligned with the intentions of an integrated TGS that is supported by an appropriate contract form (Lowe, 2013). The supply chain structures in Southern African construction, which include countries such as Malawi and South Africa are often fragmented because of the focus on contract data and other people related issues (Emuze et al., 2015).

The establishment of an alternative governance structure that promote SCM ethos is vital for the continued improvement of the construction industry in South Africa and other countries in which construction is a major contributor to gross domestic product (GDP) (Dainty et al., 2001). Instead of setting up multiple contracts with various actors within a supply chain, multiple-party agreement based on partnership could be established as clearly explained in the literature (Forbes and Ahmed, 2010, Rubrich, 2012). These partnerships will establish 'true' information sharing mechanism. For example, where information is being exchanged, the contractor would be fully aware of the actual budget of the project, and consultants would also be fully aware of how the contractor built-up his rates, etc. If necessary, a confidentiality agreement could be incorporated in such contract agreement. Additionally, risk-sharing will be possible, instead of risk being transferred to different parties according to their duties (Hallikas et al., 2004). This risk-sharing will lead to rewards / profits being equally transferred, as IPD promotes early contractor involvement (Rubrich, 2012). This means that the conventional payment structure of the case project would need to alter to a certain extent, if the parties are convinced about the benefits of IPD. As an illustration, milestones need to be established by the project team at inception, and in achieving these milestones; all parties could receive an incentive bonus. In other words, a TGS based on partnership could eliminate the need for a single gatekeeper through a contract data – the JBCC in this case. The parties forming the IPD will not only

protect clients' interests, but also, they would have an interest to act appropriately regarding a dispute resolution medium (Forbes and Ahmed, 2010).

Objective 2: Determine how transaction governance structures function within a supply chain

As shown in this case project, in South Africa, consultant-contractor relationships are plagued with mutual distrust and antagonism. Perhaps, the JBCC principal agreement may be unintentionally promoting a situation where intricate surveillance and control centered on construction programs, certification of milestones, bill of quantities, and cash flow schedule, is compensating for the absence of trust between project parties. This in turn generates many hidden transaction costs. For example, there is a need to pay specialized staff that must operate all control systems. The relationships is such that all risk for non-completion is placed on the contractor, while the professional team bears little risk, but receive substantial percentage of professional fees prior to start of construction; this removes the anchor keeping most of the professional team completely interested in the project from beginning to end. Hence, a TGS that should aim to minimize risks and maximize successful completion of the works is evidently lacking in this case project in contrast to practices advocated in the lean construction research and practice community (Sakal, 2005, Kent and Becerik-Gerber, 2010). A construction contract should function in a supply chain as a cost-controlling mechanism, risk minimizer, and a template for project delivery (Pishdad-Bozorgi et al., 2013). This is not the case in the researched project. Therefore, the case project requires a platform in which an integrated TGS can be applied, especially with the use of lean construction techniques so that culture and orientation may be positively altered to improve the decision-making process and client satisfaction.

CONCLUSIONS

An exploratory study on TGS and opportunities for 'lean' is the foundation for this paper. The nature of contracts employed to monitor transactions among supply chain members in the case study hinders the implementation of an integrated SCM structure, and is contributing to antagonistic relationships within the chain. There is a chance to look at lean IPD for improving the status quo. Regarding the central query of the study, TGS does affect the supply chain in South Africa. The industry should however move away from this TGS practice, which promote one-off relationships where parties protect individual interests. Rather, the industry should adopt practices, which provide a basis for IPD. As opposed to technology such as BIM, the lean IPD that promotes collaborative communication, joint risk-reward sharing, and withdrawal / assignment should be considered.

Based on the perceptions of the interviewees, SCM members in the project interact with one another based on signed contractual guidelines. The interaction is governed by the JBCC that is used for engaging the services of everyone involved in the project. The traditional tendering system, which is supported by the JBCC that is used to govern contracts is failing to promote collaboration. This realisation from the exploratory study requires further assessment of how different transactions that take place in a construction project life cycle are coordinated and controlled so that client's requirements are met. There is a need to find out how SCM principles could be used to govern project teams in favour of reduced reliance on complex contracts. Similar

'how' questions should form the basis of future research on TGS and SCM in South Africa?

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REFERENCES

- Akintan, O.A. & Morledge, R. 2013. Improving the collaboration between main contractors and subcontractors within traditional construction procurement. *Journal of Construction Engineering*, 2013, 1-11.
- Benton, W. & McHenry, L.F. 2010. *Construction purchasing & supply chain management*, McGraw-Hill New York.
- Dainty, A.R., Millett, S.J. & Briscoe, G.H. 2001. New perspectives on construction supply chain integration. *Supply chain management: An international journal*, 6, 163-173.
- Dong, N.T., Khanzode, A. & Lindberg, H. Applying lean principles, BIM, and quality control to a construction supply chain management system. Proceedings of the 30th CIB W78 International Conference October 9-12, 2013, 2013 Beijing, China 535-544.
- Emuze, F. 2015. Lean supply chain management in construction: Insights from Keywords. *Proceedings of the 4th Construction Management Conference*. Port Elizabeth, South Africa.
- Emuze, F. & James, M. 2013. Exploring communication challenges due to language and cultural diversity on South African construction sites. *Acta Structilia*, 20, 44-65.
- Emuze, F., Kadangwe, S. & Smallwood, J. 2015. Supply chain structures in construction: views from Malawi. *Proceedings of the Institution of Civil Engineers-Municipal Engineer*, 168, 199-205.
- Flyvbjerg, B. 2006. Five misunderstandings about case-study research. *Qualitative inquiry*, 12, 219-245.
- Forbes, L.H. & Ahmed, S.M. 2010. *Modern construction: lean project delivery and integrated practices*, CRC Press.
- Hallikas, J., Karvonen, I., Pulkkinen, U., Virolainen, V.-M. & Tuominen, M. 2004. Risk management processes in supplier networks. *International Journal of Production Economics*, 90, 47-58.
- Kent, D.C. & Becerik-Gerber, B. 2010. Understanding construction industry experience and attitudes toward integrated project delivery. *Journal of construction engineering and management*, 136, 815-825.
- Khalfan, M., Khan, H. & Maqsood, T. 2015. Building information model and supply chain integration: A review. *Journal of Economics, Business and Management*, 3, 912-916.
- Khalfan, M., Mcdermott, P. & Cooper, R. Integrating the supply chain within construction industry. proceedings of 20th ARCOM Conference, 2004. 897-904.
- Longhurst, R. 2009. Interviews: In-depth, semi-structured. *International encyclopedia of human geography*, 580-584.

- Lowe, D. 2013. *Commercial Management: Theory and Practice*, John Wiley & Sons.
- Ofori, G. 2012. *Contemporary Issues in Construction in Developing Countries*, London, Routledge.
- Othman, A. & Harinarain, N. 2009. Managing risks associated with the JBCC (principal building agreement) from the South African contractor" s perspective. *Acta Structilia*, 16, 83-117.
- Patterson, J.L., Forker, L.B. & Hanna, J.B. 1999. Supply chain consortia: the rise of transcendental buyer–supplier relationships. *European journal of purchasing & supply management*, 5, 85-93.
- Pishdad-Bozorgi, P., Moghaddam, E.H. & Karasulu, Y. Advancing target price and target value design process in IPD using BIM and risk-sharing approaches. 49TH ASC Annual International Conference Proceedings, 2013. 49.
- Pryke, S. 2012. *Social network analysis in construction*, Oxford, UK, John Wiley & Sons.
- Richards, P., Bowen, P., Root, D. & Akintoye, A. 2005. Client strategic objectives: the impact of choice of construction contract on project delivery. *Construction Law Journal*, 21, 473.
- Rubrich, L. 2012. *An introduction to lean construction: applying lean to construction organizations and processes*, Fort Wayne, IN, WCM Associates LLC.
- Rust, F. & Koen, R. 2011. Positioning technology development in the South African construction industry: a technology foresight study. *Journal of the South African Institution of Civil Engineering*, 53, 02-08.
- Sakal, M.W. 2005. Project alliancing: a relational contracting mechanism for dynamic projects. *Lean Construction Journal*, 2, 67-79.
- Tennant, S. & Fernie, S. 2012a. The commercial currency of construction framework agreements. *Building Research & Information*, 40, 209-220.
- Tennant, S. & Fernie, S. 2012b. An emergent form of client-led supply chain governance in UK construction: Clans. *International Journal of Construction Supply Chain Management*, 2, 1-16.
- Williamson, O.E. 1979. Transaction-cost economics: the governance of contractual relations. *The journal of law & economics*, 22, 233-261.
- Williamson, O.E. 1981. The economics of organization: The transaction cost approach. *American journal of sociology*, 548-577.
- Winch, G.M. 2001. Governing the project process: a conceptual framework. *Construction Management & Economics*, 19, 799-808.
- Winch, G.M. & Carr, B. 2001. Processes, maps and protocols: understanding the shape of the construction process. *Construction management and economics*, 19, 519-531.
- Yin, R.K. 2013. *Case study research: Design and methods*, Sage publications.
- Zhang, A. 2006. Transaction governance structure: theories, empirical studies, and instrument design. *International Journal of Commerce and Management*, 16, 59-85.
- Zhang, A., Melcher, A. & Li, L. 2004. Mapping the relationships among product complexity, information technology, and transaction governance structure: a case study. *Journal of Management Systems*, 16, 41-55.