

Supply Chain Coordination and Firm Performance in the Construction Industry in Gauteng Province: South Africa

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Abstract- The construction industry is an important contributor to the economy of South Africa. In this industry, buyers and suppliers work in collaboration with each other to achieve superior supply chain performance. The purpose of this study was to investigate the influence of supplier and customer coordination on coordination effectiveness and operational performance in the construction industry in the Gauteng Province. In most previous research studies, researchers have overlooked the important considerations and variables of supply chain coordination and firm performances as environmentally-friendly exercises in the construction industry. A quantitative approach was adopted in which a survey questionnaire was used to collect data from 414 construction supply chain managers and professional employees in the Gauteng Province. The study used a non-probability convenience sampling technique to select respondents. Data were analysed with the aid of two software packages, the Statistical Package for the Social Sciences (SPSS version 27.0) and the Analysis of Moment Structures (AMOS version 27.0). The results revealed that supplier coordination, customer coordination and coordination effectiveness positively and significantly influence operational performance in the construction industry. Further, the study determines that to improve operational performance, the construction industry should advance the stages of trust, guarantee and sustainable relationships with their stakeholders

Keywords: supplier coordination; customer coordination; coordination effectiveness; operational performance.

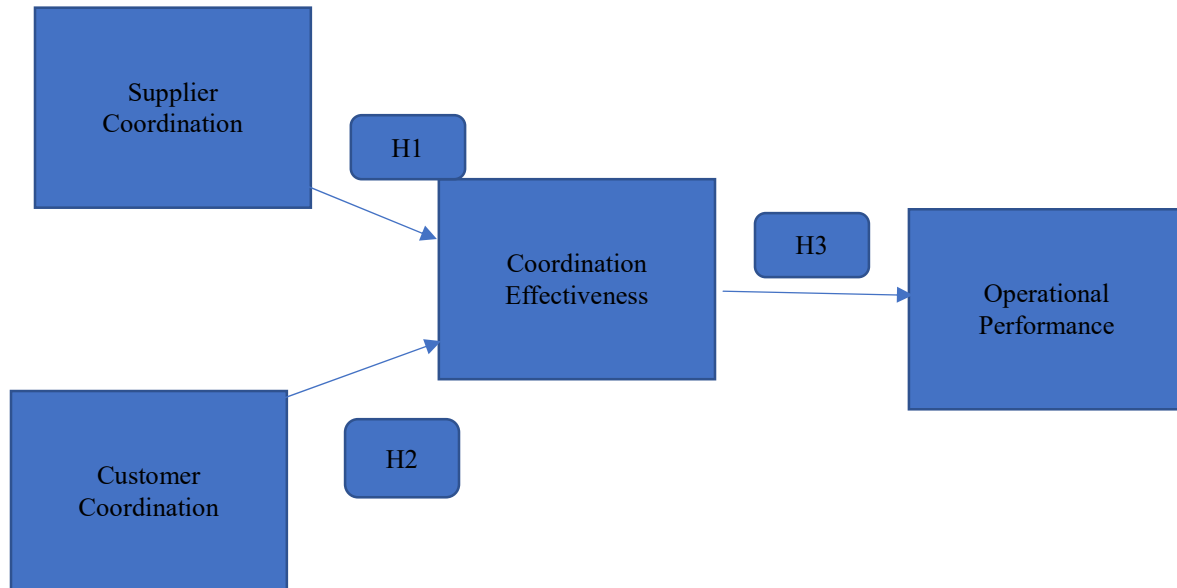
I. INTRODUCTION

the construction industry has seen momentous improvements. however, there had always been hazardous issues such as skill shortage, health and safety and communication, to mention a few that had affected the performance of the construction industry. this study is basically about the firm performance in the construction industry in the gauteng province. an understanding of performance from the viewpoint of previous studies is part of the foundation of the overall study. then, this calls for more analysis on how the construction industry implemented supply chain coordination to improve firm performance in the construction industry in the gauteng province. the construction industry has advanced the development process by providing many employment opportunities and with this rapid development of urbanisation, many construction projects are needed to fulfil people's growing needs and to substitute progressively aging structures (xu & xu 2021).

II. PROBLEM STATEMENT

Although there has been an outstanding development of the construction industry, there are numerous challenges facing the industry, mostly because of the construction costs, on-time project achievement, tendering procedures and technical expertise (Mahmood, Zahari, Yaacob & Zin 2017). The main problem that this study will investigate is how poor performance affects the construction industry. Previous studies have shown that the process of construction, depending on the complexity of the completed structure, requires a high level of coordination among all the specialists from design until the project is completed (Liu, Van Nederveen & Hertogh 2017). However, efforts of designing a coordination scheme that will align the incentives of marketing and production with the firm's general objectives need to be executed (Pekgün, Griffin & Keskinocak 2008). Therefore, according to Pozin and Nawi (2017), since construction is one of the most information-dependent industries amongst others, with its mixture of forms of information, supply chain coordination will be the crucial factor leading to the success of the construction industry. Although numerous studies have been done to address the problem of performance in the construction industry, the application or execution of supply chain coordination has not been given much consideration to examine how it will advance performance in the industry. Therefore, there is a need to investigate the impact of supplier and customer coordination on coordination effectiveness and operational performance in the construction industry in the Gauteng province.

RESEARCH MODEL



HYPOTHESIS STATEMENT

H1: There is a positive relationship between supplier coordination and coordination effectiveness.

H2: There is a positive relationship between customer coordination and coordination effectiveness.

H3: There is a positive relationship between coordination effectiveness and operational performance.

LITERATURE REVIEW

This facilitated the critical analysis of the literature through comparing and constructing the perspectives, viewpoints and arguments by other researchers in similar studies.

A game-theory approach to supply chain coordination

To obtain a suitable contextual and organisational understanding of this study, the game theory suggested by Von Neumann and Morgenstern (1944) was used to observe the influence of supplier and customer coordination on coordination effectiveness and operational performance. The theory suggested that both supplier and customer coordination can improve worldwide performance and decrease risks (Hennet & Arda 2008). As stated by Chopra and Meindl (2010), supply chain coordination progresses if the total supply chain profits grow through the actions in which all stages of the supply chain collectively participate. Hennet and Arda (2008) suggest that cooperative game theory can be of great help in designing a supply chain or an essential enterprise by selecting an optimal coalition of partners.

Supplier coordination

Supplier coordination is viewed by Boyce, Mano and Kent (2016) as a state of synchronisation of supply chain cooperation that has the potential to reduce the natural conflict in supply chain relationships. However, Jayaram, Xu and Nicolae (2011) define supplier coordination as a key aspect for manufacturers to stay competitive in today's overall competition. Furthermore, Aljazzar, Jaber and Moussawi-Haidar (2016) define supplier coordination as an intercessor between customer and manufacturing lead-times.

Customer coordination

According to Foss, Laursen and Pedersen (2011), customers and clients are a basis of knowledge or information in their innovative developments. Then, Chavez, Yu, Gimenez, Fynes and Wiengarten (2015) define customer coordination as that which involves improving performance in areas such as manufacturing and delivery lead-time and delivery consistency to achieve the primary goal of the business. Moreover, Jayaram *et al.* (2011) define customer coordination as a tool that allows the manufacturing firm to clearly realise customers' special needs and specifications and arrange its internal resources to serve such exceptions effectively.

Coordination effectiveness

Effective coordination is the concealed force multiplier in emergency response as it reduces repetition and competition and allows different agencies and organisations to complement each other and give additional value (Office for the Coordination of Humanitarian Affairs 2014). However, Hugos (2018) states that the effectiveness of an organisation's supply chain is how well the company can do and how it can compete in its markets successfully.

Operational performance

Operational performance is a set of principles or ethics and benchmarks that are applied and used by firms to achieve a competitive advantage, customer fulfilment and extreme levels of effectiveness (Saleh 2015). Even Chatfield and Pritchard (2013) note that operational performance involves lead times of manufacturing and distributions that are acknowledged among the processes that largely influence the effectiveness of operations in the supply chain.

Supplier coordination and coordination effectiveness

Previous researchers pointed out that supplier coordination leads to various advantages such as knowledge sharing and new product development, thus leading to operational effectiveness within the construction industry (Cao & Zhang 2011). Similarly, Glenn Richey, Adams and Dalela (2012) state that supplier coordination enables the construction industry to plan and conduct several activities in a cooperative and coordinated way. As a result, the construction participants will be able to share information and this will help them resolve their differences in time and learn from each other over time. This being the case, the following hypothesis has been formulated:

H1: There is a positive and significant relationship between supplier coordination and coordination effectiveness.

Customer coordination and coordination effectiveness

It is highlighted that customer coordination mostly leads to superior quality effectiveness in the supply chain (Ramanathan, Bentley & Pang 2014). Wang, Lee, Fang and Ma (2017) state that customer coordination enables the supplier to modify its products better, which should increase the value of project development and improve the supplier's sales performance by reducing costs. The same authors postulate further that customer coordination is proven to make interactions more effective by decreasing costs and making investments more efficient by targeting the exact needs of an individual. Resulting from the above-mixed results, the following hypothesis is suggested:

H2: There is a positive and significant relationship between customer coordination and coordination effectiveness.

Coordination effectiveness and operational performance

Coordination effectiveness has been regarded as an important factor benefitting the building end-user through reduction of faults, lead times and costs in design and construction during operations (Gerrish, Ruikar, Cook, Johnson, Phillip & Lowry 2017). Thus, Santa, MacDonald and Ferrer (2019) postulate that for the construction industry to fulfill its operational performance effectively, five performance dimensions such as cost, quality, reliability, flexibility and speed need to be attained. Furthermore, Mackelprang, Robinson, Bernardes and Webb (2014) claim that the industry's coordination with its supply chain partners improves operational performance

through processes such as joint commitments, dedicated relationships, knowledge sharing and developed products design. This discloses the influence of coordination effectiveness leading to the following hypothesis:

H3: There is a positive and significant relationship between coordination effectiveness and operational performance.

Table 1: Scale accuracy analysis

Research constructs		Descriptive statistics		Cronbach's test		CR value	AVE value	Factor loading
		Mean	SD	Item total	α Value			
SUPPLIER COORDINATION	SC1	4.418	3.663	0.791	0.844	0.92	0.73	0.687
	SC2			0.895				0.805
	SC3			0.845				0.896
	SC4			0.899				0.779
	SC5			0.783				0.791
CUSTOMER COORDINATION	CC1	4.614	3.907	0.756	0.813	0.88	0.66	0.553
	CC2			0.845				0.791
	CC3			0.786				0.789
	CC4			0.847				0.634
	CC5			0.832				0.726
COORDINATION EFFECTIVENESS	CE1	4.394	3.630	0.856	0.757	0.782	0.59	0.705
	CE2			0.636				0.727
	CE3			0.704				0.735
	CE4			0.837				0.698
	CE5			0.754				0.719
OPERATIONAL PERFORMANCE	OP1	4.497	3.599	0.766	0.784	0.760	0.64	0.789
	OP2			0.842				0.645
	OP3			0.864				0.739
	OP4			0.705				0.791
	OP5			0.742				0.678

CR= Composite reliability; AVE=Average variance extracted.

** Scores: 1 – Strongly Disagree; 2-Disagree; 3 – Neutral; 4-Agree; 5 – Strongly Agree*

Validity and reliability are the main yardsticks used in quantitative research (Mohajan 2017). In the previous chapter, it was mentioned that validity and reliability would be assessed to evaluate the internal consistency in the research constructs as well as to conduct composite reliability in this research study. In the previous chapter, the study employed Cronbach alpha analysis to obtain the accepted results. It was mentioned that a high level of

Cronbach's alpha coefficient shows reliability that is high of the scale (Chinomona 2011). The Cronbach's alpha values in this research range from 0.79 to 0.91. Moreover, Taber (2018) mentions that a set of items that can be considered is from a minimum of 0.7. Therefore, the scales used in this study are reliable.

Table 2: Results of hypotheses testing (path modelling)

Proposed hypothesis Relationship	H	PCE	P-V	D
Suppliers coordination to coordination effectiveness	H1	0.885	***	Accepted
Customers coordination to coordination effectiveness	H2	0.553	***	Accepted
Coordination effectiveness to Operational Performance	H3	0.564	***	Accepted

H= Hypothesis PCE= Path Coefficient Estimates PV= P- Value D=Decision

As shown in Table 2, the researcher presents the level of coefficients of all the 3 hypotheses and the level of $p < 0.01$. The significance levels of $p < 0.05$, $p < 0.01$ and $p < 0.01$ are indicators of either positive, strong and significant relationships between the research constructs (Chinomona, Lin, Wang & Cheng 2010). Based on that, all of the three hypotheses proposed in this research study were supported and accepted.

Discussion of the results

In this subsection, the study presented that the results of the hypotheses (H1 to H3) are at a significant level and support at a confidence level of $p < 0.01$. The following subsections present and discuss the hypotheses as indicated in Table 1 and 2.

Results for hypothesis 1

The first hypothesis (H1) in this study stated that there is a positive relationship between supplier coordination (SC) and coordination effectiveness. The path coefficient of (H1) is 0.885. This value indicates a very strong relationship between supplier coordination and coordination effectiveness. Thus, the p-value is significant at 99% ($r = 0.001$), which means this hypothesis is supported and significant. These results are in line with a study conducted by Gay and Norrman (2016), which showed that proper supplier coordination leads to proper coordination effectiveness.

Results for hypothesis 2

About the second hypothesis (H2), the study hypothesised that there is a positive relationship between customer coordination and coordination effectiveness. Table 2, show the path coefficient value of ($r = 0.553$) with p-value is significant at 99%. The positive correlation found between customer coordination and coordination effectiveness is consistent with the results provided by Rahardja, Anandya and Setyawan (2018). From this research study, it can be concluded that the relationship between customer coordination and coordination effectiveness increases performance in the construction industry. These authors further point out that trust plays a vital role in attaining a relationship between customer coordination and coordination effectiveness because it can upturn profits for supply chain partners.

Results for hypothesis 3

A positive correlation was hypothesised between coordination effectiveness and operational performance. After testing H3, a path coefficient of ($r = 0.564$) was obtained. The result confirms that there is a positive relationship between coordination effectiveness and operational performance. The relationship between these two constructs is highly significant at 99% indicated by a ($p < 0.001$). Truong and Hara (2018) state that operational performance includes those indicators that reflect the main objectives of the industry by minimising cost and waste that results in higher performance. The results confirm or validate the existence of the relationship between coordination effectiveness and operational performance. These results are consistent with the results of Le Tuong and Vo Hong (2014) whereby commitment was found to be the most significant factor to influence the relationship between coordination effectiveness and operational performance.

CONCLUSIONS AND RECOMMENDATIONS

Supplier coordination, customer coordination and coordination effectiveness will improve the performance of the construction industry. Furthermore, trust, commitment and transparency between supplier coordination and customer coordination will enable the construction industry in achieving the main goal, which is performance. Construction workers should be given training to gain knowledge and practical guidelines regarding the implementation of projects as well as how to utilise tools and resources to avoid waste. Management should always support construction workers and involve them in the decision making of the business to increase their morale. Since the construction industry contributes towards the economy of the country, through the gross domestic product (GDP), gross fixed capital creation, the establishment of employment opportunities and industrial productivity, more regulations should be imposed to keep the industry sustainable. Theoretical contributions have been made to the existing literature. The main results of this study support the game theory developed by Von Neumann and Morgenstern (1944), which focuses on collaboration amongst teams and how they make strategic decisions. In this regard, supply chain coordination has played an important role in the performance of the construction industry. The study also emphasized the significance of supply chain coordination by enlightening that supply chain partners may be engaged in a relationship to attain the main goal of the construction industry. Therefore, it is important to know and understand the importance of supply chain coordination in the construction industry.

LIMITATIONS AND FUTURE RESEARCH DIRECTIONS OF THE STUDY

The present study had certain limitations that suggested directions for future studies. The study was limited only to the construction industries in the Gauteng province for additional provinces did not form part of this study. The study was carried out during the time of the Covid-19 pandemic. For this reason, questionnaires were distributed and collected at a later stage. This meant that the researcher could not monitor how respondents in this study completed the questionnaires. Furthermore, the study focused on four variables and did not include other variables such as buyer supplier coordination and general performance appraisal. This study adopted a quantitative method, which limited respondents from providing detailed narrative experiences. When conducting a study on the construction industry, other provinces should be considered to yield greater results. For this, data can be collected online. Additionally, future studies should also make use of a qualitative method to obtain in-depth insight into the influence of supply chain coordination and firm performance in the construction industry. Moreover, further research within the construction industry may be to identify a general measurement that can be used to measure the effectiveness of a coordinated supply chain. This experience will help in the future to better understand supply chains and their complexity. Also, the supply chain coordination subject, which is the key ground of this study, will become more significant in the future as there occurs an increased opposition between supply chains and a need for collaboration beyond the construction industry's borders.

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