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Optimising supply chain effectiveness among state-owned enterprises in South Africa

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Background: State-owned enterprises (SOEs) play an important role in the economies of many developed and developing countries. However, most SOEs fail to provide efficient or effective public service delivery. Therefore, it is necessary to investigate how SOEs in Gauteng province in South Africa can enhance supply chain effectiveness (SCE).

Objectives: In the study, the relationships are investigated between total quality management (TQM), competitive advantage (CA), innovation (IN), SCE in the selected South African SOEs in Gauteng province.

Method: A quantitative design was adopted in which a survey questionnaire was administered to 863 supply chain practitioners working in SOEs in South Africa Gauteng province. Data were analysed with the aid of Statistical Package for Social Science (SPSS 27.0) and SMART PLS (version 3.0).

Results: The results of the study showed that knowledge management and CA predict the establishment of SCE in SOEs in the Gauteng province. However, IN was not supported but is of significance towards achieving SCE in SOEs in the Gauteng province.

Conclusion: The adoption of CA by SOEs over industry competitors is essential toward success.

Contribution: The results of this study will contribute to the improvement of South Africa's economy by enabling SOEs to establish a competitive edge in their respective industries.

Keywords: total quality management; competitive advantage; innovation; supply chain effectiveness; administrative management theory; South Africa.

Introduction

State owned enterprises (SOEs) occupy an important position in the economy of most countries and are one of the fundamental motives for developing countries to establish them (Madumi 2018). In South Africa, SOEs deliver an important role in state activities and service delivery to the people. The creation of the SOEs allows state management and intervention of the country's economy. Private-owned enterprises are unable to provide products and services that accommodate all people living in South Africa, therefore, government must intervene to address the inefficiencies through the creation of SOEs (Bushe 2019). In other words, the state serves the interest of the public by providing scarce products and service delivery to society (Lei & Xu 2019). Disappointingly, SOEs in the Gauteng province of South Africa are insolvent because of mismanagement and thus need government financial support in the form of bailouts (Mafukata & Musitha 2018; Vanichchinchai 2014). Despite the growing salience of SOEs, limited research has been performed on the intangible resources that these firms deploy to thrive, especially with respect to supply chains. Enhancing supply chain effectiveness (SCE) calls for SOEs to strengthen total quality management (TQM), competitive advantage (CA) and innovation (IN) through their existence (Feng 2020). The direction and dynamics of change in the level of TQM, CA and IN determines the factors for SOEs SCE management tools in the long- and short-term (Sari et al. 2018).

Problem statement

Even though SOEs play an important role in the economies of many developed and developing countries, the majority fail to be sustainable (Molocwa, Khamfula & Cheteni 2018). A study by Xin, Bao and Hu (2019) has indicated that most SOEs fail to contribute efficiently or effectively towards economic growth or delivering of public services. South

African SOEs are failing because of mismanagement, debt burdens, underinvestment, depreciation of assets, corporate governance quagmires and corruption, to mention but a few (Dash, Panda & Kumar 2018). However, the state keeps injecting them with bailouts to enable service delivery to the people (Carlson & Bussing 2020). The enormous debts that SOEs have incurred is a serious threat to the economy and most are failing to deliver products and services they are mandated to provide (Mutize & Tefera 2020).

Although researchers have studied these antecedents, which are TQM, CA and IN separately in different settings and contexts, very little research has been done on how TQM, CA and IN could sustain the benefits and value of a long-term SCE among SOEs (Cullinan, Abratt & Mangione 2020). In recognition of this scarcity, the present study seeks to fill this research gap and perhaps reveal significant relationships between TQM, CA and IN on SCE.

By filling this gap in academic literature, the study will contribute new empirical literature, findings, and concepts that may encourage more research into related antecedents that lead to SCE. Furthermore, the study will help to motivate SOEs to reassess their level of TQM, CA and IN desired to compete in the market environment. These findings will also aid in the improvement of South Africa's economy through the effectiveness and competencies of the SOEs. An important incentive and motivation to conduct the study is the fact that researchers have not given this subject much attention in the context of South Africa.

Conceptual model

Regarding the literature review, the following conceptual model has been developed (Figure 1). Relationships based on research variables will be developed thereafter. In the conceptualised research model, TQM, CA and IN are the predictor variable and SCE is the outcome variable.

Hypothesis statements

Based on the aforementioned conceptual model, the following hypotheses statements have been developed.

H1: There is a positive relationship between TQM and SCE among state-owned enterprises (SOEs) in Gauteng province.

FIGURE 1: Conceptual model.

H2: There is a positive relationship between CA and SCE among SOEs in Gauteng province.

H3: There is a positive relationship between IN and SCE among SOEs in Gauteng province.

Literature review

There will be a review of a variety of literary works, including information from books, journals, completed dissertations, and online resources. A clear understanding of the concepts involved in the study and how they affect one another will be attempted from this.

Administrative management theory

The theoretical framework of this study is outlined from the Administrative Management Theory (AMT). The AMT is a classic management theory developed by Henry Foyal, based on his personal experience as a senior manager in 1916 and it is commonly known as the Fayol administrative theory (Yadav 2020). To achieve the desired goal and to gain profit, organisations must divide activities according to people's work of specialisation (Kaul 2020). The focus of the AMT is on business and general management (Huang et al. 2019). It consists of five management functions (planning, organising, commanding, coordinating and monitoring) and 14 management principles (authority and responsibility, discipline, unity of command, unity of command of direction, subordination of individual interests, remuneration, the degree of centralisation, scalar chain, order, equity, stability of tenure of personnel, initiative, and esprit de corps) (Greve et al. 2019). Foyal's theory is well-known and still in use, especially by big organisations. Regarding AMT, the study accepts that because of the dynamic and competitive business world, South African SOEs need to use the management functions to their advantage by interlinking TQM, CA and IN to enhance SCE within the organisations. For the significance of the study, as managers and leaders face more challenging roles nowadays, it is essential for them to adopt the administrative management theory's 5 functions and 14 principles, which are likely to lead to a long-term successful SOE performance. By understating their roles and responsibilities as managers and learning from their subordinates, they can understand better how they should handle employees and build their own management principles, which can be effective and efficient in their work environment.

Total quality management

Total quality management was introduced by the Japanese as a management approach in early 1980 to enhance productivity and quality in the organisation (Honarpour, Jusoh & Md Nor 2018). Its introduction on reforms to management and operational structures, has been proven to be valuable to both private and public organisations (Abbas 2020). The TQM can only succeed when employees join in various organisation processes and procedures and undergo training to enhance their skills (Muruganantham et al.
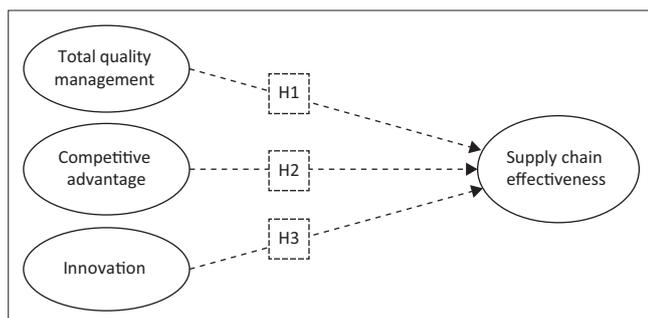
2018). Employers play an important role while implementing quality management, hence employees are key elements of the business (Zhou 2016). For a business to successfully implement effective TQM, the recipient firm must empower capable leaders to exhibit project management skills (Pimentel & Major 2016). The increase of customer satisfaction is the goal of TQM, which is achieved through products and services quality improvement with less consumption of resources (Abbas 2020). Organisations have adopted TQM to strengthen their organisational effectiveness (Vanichchinchai 2014). The culture of an SOE is an essential success factor and senior management must acknowledge and provide support to implement TQM (Sahoo & Yadav 2017).

Competitive advantage

Competitive advantage is the ability to outperform business competitors by producing and offering better goods, services and above-average profit through the execution of an applicable business strategy (Fainshmidt et al. 2019). Competitive advantage is the fundamental components of the SOEs culture that is associated with effective organisational performance (Eldor 2020). To gain CA, an organisation's supply chain (SC) must be agile, adaptable and aligned (Abeysekara & Kuruppuarachchi 2019). The SOEs policy thus formalises the values and requirements for ethical behaviours and influences competitive status (Singh et al. 2019). The SOEs that indulge in high standards of management systems avoid any problems, if any, with protecting and improving the image of the enterprise (Udriyah, Tham & Azam 2019). The CA stems when SOEs aligns its workers' skills, processes behaviour with the system as well as training of employees to develop systematic capabilities at a business level (Coccia 2017). In the era of growing pressure from directors to perform, SOEs needs to manage external challenges with effective internal capabilities and training of employees to deal with such pressure; therefore, it will have a CA in the market (Gunasekaran, Subramanian & Papadopoulos 2017).

Innovation

Innovation is defined as a significant part of introducing a new and improved product or service to the market as well as introducing new or better improved processes within the organisation (Lashitew, Bals & Van Tulder 2020). Thus, IN plays a key role in job creation, competitiveness, and the welfare of any organisation (Freire 2019). The diffusion of IN throughout the economy is mainly through the result of the accumulation of knowledge, which aims at new development of capabilities throughout the organisation (Freire 2019). Sharing of knowledge by all organisations in a supply chain network, provides mutual learning and creates new value (Wang & Hu 2020). Innovation development dynamics determine the rate and direction of the change in technology by specific physiognomies of the economic and industrial structure of the system to each point in time, as well as their

well-being (Varadarajan & Kaul 2018). The behaviour of the entire economy influences the idea that dominates the whole technological system through the concept of IN (Gebauer, Haldimann & Saul 2017).

Supply chain effectiveness

Supply chain effectiveness is defined as a joint success of enterprise that achieves expected targets of the supply value chain, which are consistency, originality, and responsiveness towards customer needs (Zailani et al. 2019). The SCE is enhanced when business and functional strategic methods are implemented by all members in the supply chain (Nazempour, Yang & Waheeda 2020). An organisation could increase its position over its competitors by strengthening its SCE (Wang et al. 2018). In modern markets, SOEs need to be managed towards effectiveness to keep up with competitors and raise their level of excellence (Peñarroja et al. 2019). The SCE assumes the existence of different levels placed in the supply chain, which are determined by predictability (the variability in achieving objectives) and control (actual results and targets) (Günsel et al. 2019).

Research methods and design

Research scales were operationalised based on previous work. Proper modifications were made to fit the current research context and purpose. Total quality management measure used a six-item scale adapted from Talib, Rahman and Qureshi (2013), while CA used a six-item scale adapted from Aydiner et al. (2019). Finally, innovation was measured using an eight-item scale adapted from Zhang et al. (2007). All the measurement items were measured on a five-point Likert-type scale that was anchored by 1 = strongly disagree to 5 = strongly agree to express the degree of agreement.

Measurement instruments

The researcher checked the measurement's reliability and validity. Reliability was mainly checked using the composite reliability (CR) and Cronbach's alpha value. To ensure convergent validity, the researcher checked whether items loaded on their respective (a priori) constructs with loadings greater than 0.5. Discriminant validity was checked by average variance extracted (AVE) value, ensuring that there were no insignificant inter-research variable cross-loadings (Schrepp, Hinderks & Thomaschewski 2017). Smart PLS performs a confirmatory factor analysis (CFA) while estimating the structural equation model (SEM). The CFA results are reported in Table 1, Smart PLS results are accessible in Figure 2 and Table 2. SEM results are presented in Table 3.

Psychometric properties of the measurement scale

Table 1 reports on the psychometric properties of the measurement scale. It shows the research constructs, descriptive statistics, Cronbach's alpha test, CR, AVE and item loadings.
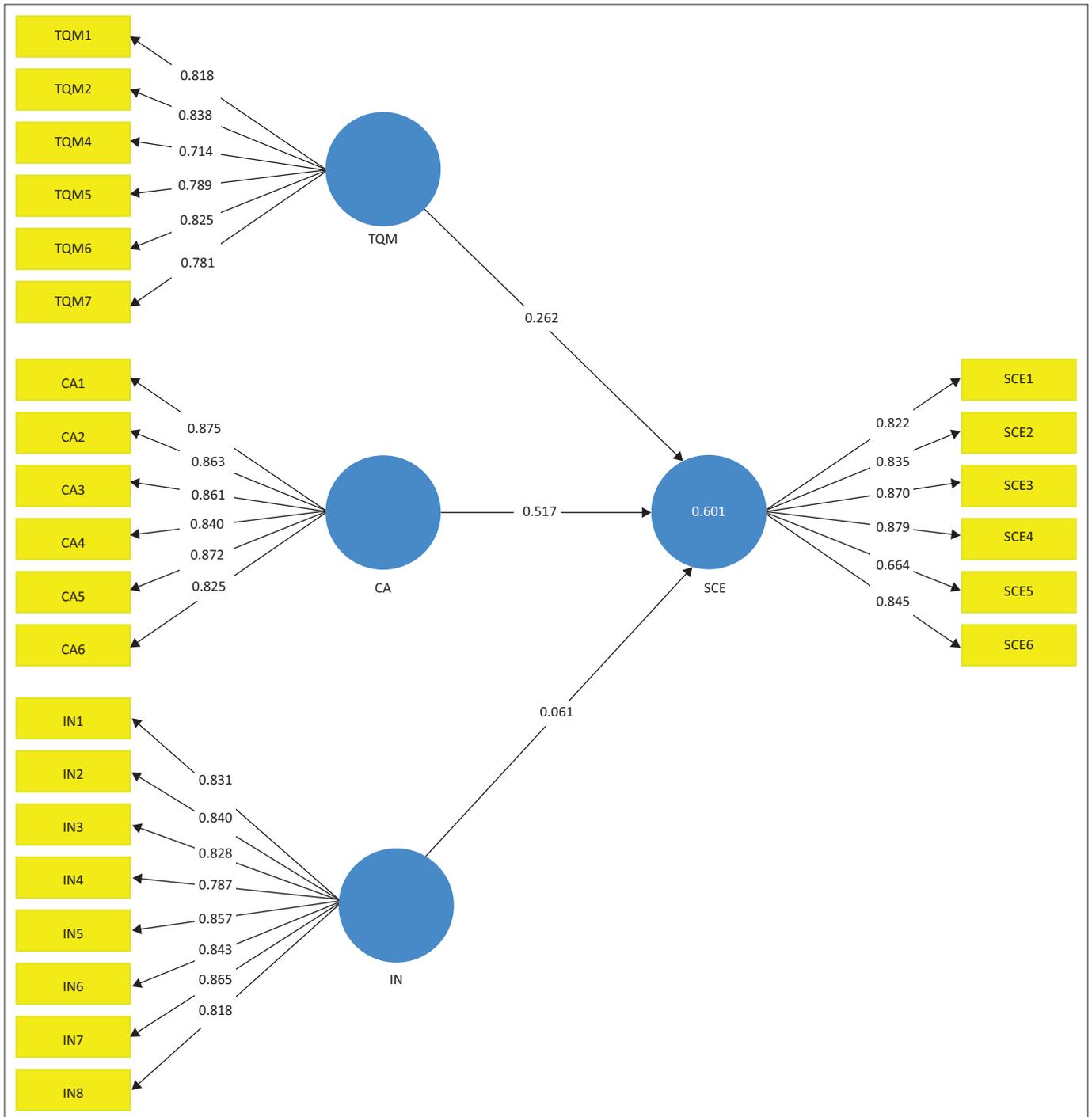
CA, competitive advantage; IN, innovation; SCE, supply chain effectiveness; TQM, total quality management.

FIGURE 2: SMART PLS Figure from the Software.

As highlighted in Table 1, all items have loadings greater than 0.6 (Nunnally & Bernstein 1994), indicating that they explain at least 60% of what they expected to measure (convergent validity). Total quality management is ranked first with the lowest AVE score value of 0.632, which exceeds the recommended 0.5 (Fornell & Larcker 1981). This indicates the degree to which the respondents agreed that TQM is an important variable to attain SCE. The CA is ranked as a second factor, which scored the highest AVE value of 0.733. This demonstrates the degree to which the respondents agreed that CA was instrumental in obtaining high level of performance when there is sustainability within SOEs. The third ranked factor is IN with AVE score value of 0.696. This indicates the degree to which the respondents agreed that IN increases SCE when quality is properly managed. The fourth ranked factor is SCE with AVE value of 0.676. This shows the degree to which respondents agreed that SOEs can achieve SCE through sustainable CA, continuous improvement on IN, and quality management. Using the CR value and Cronbach's alpha value, the measurement instrument's reliability was assessed, and the lowest and the highest values are 0.911 and 0.926, respectively, which

TABLE 1: Accuracy assessment and descriptive statistics.

Research constructs	Descriptive statistics		Cronbach's alpha test	CR	AVE	Item loading
	Mean	SD	α value			
Total quality management (TQM)			0.883			
TQM1	-	-	-	-	-	0.818
TQM2	-	-	-	-	-	0.838
TQM4	0.259	0.046	-	0.911	0.632	0.714
TQM5	-	-	-	-	-	0.789
TQM6	-	-	-	-	-	0.825
TQM7	-	-	-	-	-	0.781
Competitive advantage (CA)	-	-	0.927	-	-	-
CA1	-	-	-	-	-	0.875
CA2	-	-	-	-	-	0.863
CA3	0.517	0.040	-	0.943	0.733	0.861
CA4	-	-	-	-	-	0.840
CA5	-	-	-	-	-	0.872
CA6	-	-	-	-	-	0.825
Innovation (IN)	-	-	0.937	-	-	-
IN1	-	-	-	-	-	0.831
IN2	-	-	-	-	-	0.840
IN3	0.065	0.041	-	0.948	0.696	0.828
IN4	-	-	-	-	-	0.787
IN5	-	-	-	-	-	0.857
IN6	-	-	-	-	-	0.843
IN7	-	-	-	-	-	0.865
IN8	-	-	-	-	-	0.818
Supply chain effectiveness (SCE)	-	-	0.903	-	-	-
SCE1	-	-	-	-	-	0.822
SCE2	-	-	-	-	-	0.835
SCE3	-	-	-	-	-	0.870
SCE4	-	-	-	0.926	0.676	0.879
SCE5	-	-	-	-	-	0.644
SCE6	-	-	-	-	-	0.845

TQM, total quality management; CA, competitive advantage; IN, innovation; SCE, supply chain effectiveness, AVE, average variance extracted; CR, composite reliability; SD, standard deviation.

TABLE 2: Inter-construct correlation matrix.

Variables	CA	IN	SCE	TQM
CA	0.856	-	-	-
IN	0.659	0.834	-	-
SCE	0.748	0.584	0.822	-
TQM	0.729	0.695	0.681	0.795

TQM, Total quality management; CA, competitive advantage; IN, innovation SCE, supply chain effectiveness.

Note: Correlation is significant at the 0.01 level (2-tailed).

TABLE 3: Results of structural equation model analysis.

Path	Hypothesis	Path coefficients (β)	*p*-value	T- Statistics	Decision on hypotheses
TQM → SCE	H1	0.262	0.000	18.407	Supported and significant
CA → SCE	H2	0.517	0.000	14.723	Supported and significant
IN → SCE	H3	0.061	0.139	3.571	Not supported but significant

TQM, total quality management; CA, competitive advantage; IN, innovation; SCE, supply chain effectiveness.

exceeds the recommended acceptable value of 0.5 (Nunnally & Bernstein 1994). All in all, these results confirm the reliability and validity of the measurement used in the study.

The correlation confirms the association and direction of the association between the constructs, apart from confirming discriminant validity. Ranging from 0.584 to 0.856, it confirms that inter-factor correlations were positive and significant. There is also a positive correlation coefficient ($0.659 \leq r \leq 0.822$) between IN and SCE. Moreover, an analysis of the relationship between the mediating variable, TQM and SCE, which is the outcome variable, has a positive significant relationship ($r = 0.856$; $p < 0.01$). The estimation of coefficients and the calculation of confidence intervals were not compromised, as no normality was violated. On normally distributed data, the procedure at its initial stage has potential to manipulate relationship and significance tests. Therefore, this result indicates that when one construct increases, the other constructs are expected also to have a positive increase, while the reverse is true.

As illustrated in Table 2, there are positive correlations across all constructs and they are all below the level of 1.0, which proves the adequacy of discriminant validity in the measurement scale (McFarland 2020).

Path model outcomes and factor loadings

Table 3 indicates the path-co-efficiency results and the T-Statistics for the research constructs.

Table 3 shows the minimum T-statistics for the path coefficients is 3.571, which is greater than the recommended threshold of 1 (Winship & Zhuo 2020). This means that all of the proposed relationships are significant. Even so, for the relationship to be supported, the *p*-values must be less than 0.01 (Jafari & Ansari-Pour 2019). This demonstrates that innovation in South African SOEs does not influence SCE. However, the results were significant based on the T-statistics, meaning they can be considered accurate.

Ethical considerations

Ethical clearance to conduct this study was obtained from the Vaal University of Technology Faculty Research Ethics Committee (No. FRECMS-21072021-074).

Discussion of results

The purpose of this study was to investigate the influence of TQM, CA and IN on SCE among SOEs in the Gauteng province of South Africa. In particular, three hypotheses were postulated. To test the proposed hypotheses, data were collected from Gauteng province in South Africa. The empirical results supported all the posited research hypotheses in a significant way. Important to observe about the study's findings is the fact that IN has stronger effects on SCE (0.937) than CA (0.927) and TQM (0.883). Although for the relationship between IN and SCE to be supported the *p*-value (0.139) should be less than 0.01. Perhaps this could be because of the fact that customers are likely to trust and be more attached to SOEs that offers quality product or service. Nevertheless, all the measured constructs were found to be significant based on the T-statistics results.

The first research objective was to examine the relationship between TQM and SCE. A coefficient of 0.262 was realised after testing H1. This indicates that TQM has a strong and positive influence on SCE. The results, therefore, support the relationship as hypothesised. Judging from the results, it can be understood that TQM raises awareness of environmental issues and creates normative responses that promote the application of a SCE. This denotes that TQM has a positive and relatively strong influence on SCE, which concurs with the results of the studies conducted by Zhou (2016) and Abbas (2020), where TQM is positively associated with SCE.

The second objective was to scrutinise the relationship between CA and SE. Also, in support of Hypothesis 2 (H2), the results validated the presence of a relationship between CA and SCE with a path coefficient of 0.517. This denotes that CA has a positive and relatively strong influence on SCE, which concurs with the results of the studies of Coccia (2017) and Eldo (2020), where CA is positively associated with SCE.

The third research objective was to investigate the relationship between IN and SCE. The path coefficient for Hypothesis 3 (H3) is 0.061, which indicates a reasonable but weak relationship between the two variables. Study performed by Wang and Hu (2020) also supports a strong and positive relationship between IN and SCE. Accordingly, this study validates and supports that IN has a direct impact on SCE. After analysis, it can be acknowledged that IN has an opportunity to improve SCE for companies to improve the performance of their day-to-day activities.

Implications of the study

South African SOEs can take note of the study's findings and employ these strategies to benefit their enterprises. This adds to the existing body of literature on these issues within the area of TQM, CA, IN and SCE. Future researchers may use this study as a leading source of secondary data. This includes giving hints on how best SOEs can be established, operated and supported towards ensuring effectiveness. Therefore, SOEs in developing economies will be placed in a better position to increase the level of SCE.

Limitations and future research

Several inadequacies were observed during this research. The study was restricted to three constructs only; forthcoming research could also include the other variables as supply chain collaboration, information quality and supply chain resilience as antecedents of SCE. In addition, the study can be strengthened by increasing the sample size and including participants in other geographical areas. This study was limited to South Africa. For results comparison, subsequent research should contemplate replicating this study in other developing countries. This study used a quantitative approach and imminent studies could also use a mixed method approach or purely qualitative approach so that in-depth views of employees and employers can also be captured.

Conclusion

The main objective of this article was to investigate the relationship between TQM, CA, IN on SCE. The use of TQM, CA and IN can improve an organisation's operational and financial performance in supply chain because of its effectiveness. This study indicates the significant relationship of TQM, CA and IN towards SCE. The results highlight that all the three dimensions (TQM, CA and IN) have a positive relationship with SCE. Therefore, the study provides empirical evidence that TQM, CA and IN can play an important role in enhancing SCE of SOEs in South Africa.

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Competing interests

The authors declare that they have no financial or personal relationship(s) that may have inappropriately influenced them in writing this article.

Authors' contributions

E.C.C. did the first write up of the article and data analysis. P.N. collected the data and it is part of his PHD study. L.N. provided a professional critical reading and correcting of the manuscript.

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Data availability

The data that support the findings of this study are available on request from the corresponding author, E.C.C.

Disclaimer

The views and opinions expressed in this article are those of the authors and do not necessarily reflect the official policy or position of any affiliated agency of the authors and the publisher.

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