AOSIS

Supply chain integration and resilience in Namibia's state-owned logistics enterprises at Walvis Bay Port

CrossMark
click for updates

Authors:
Anatolia T. Shooya[1]
Patmond T. Mbhele[1]

Affiliations:
[1]College of Law and Management Science, School of Management, Information and Governance, University of KwaZulu-Natal, Durban, South Africa

Corresponding author:
Anatolia Shooya,
221115944@stu.ukzn.ac.za

Background: Drawing upon the supply chain integration model, this research examined the impact of supply chain integration on resilience. Building resilient supply chains has become paramount because of the complex nature of the contemporary environment. However, adopting supply chain integration mechanisms in the Global South still needs to be stronger.

Objectives: The primary objective is to examine the impact of supply chain integration on resilience. This study aims to address the need for more robust supply chain integration mechanisms in the Global South, particularly Namibia, and to explore the relationship between supply chain integration practices and resilience in the Namibian Port Authority.

Method: This study employed a quantitative, correlational approach with a sample of 280 participants from the Namibian Port Authority to establish the relationship between supply chain integration practices and resilience. The data were analysed using Structural Equation Modelling.

Results: Statistical analysis reveals a significant direct impact of supplier, internal, customer and information sharing on supply chain resilience.

Conclusion: Building resilient supply chains is crucial because of the contemporary environment. This study provides evidence of the importance of supply chain integration practices in enhancing resilience and contributes to the scant literature on supplier integration in organisations in sub-Saharan Africa.

Contribution: This study fills a gap in the literature regarding supplier integration in organisations in sub-Saharan Africa. It offers valuable insights for logisticians on the role of supply chain integration in building resilience and provides important insights to logisticians.

Keywords: supply integration; supply chain resilience; state-owned logistics enterprises; internal integration; supplier integration; customer integration; information sharing.

Introduction

Supply chain integration is a critical factor that contributes to the resilience of different sectors of the economy, including logistics companies. By establishing strong connections and collaboration among various entities within the supply chain, organisations can enhance their ability to adapt and respond effectively to disruptions and uncertainties in the market (Ivanov & Dolgui 2019). In support of this, Christopher and Peck (2018) found that supply chain integration helps businesses establish strong bonds with distributors, suppliers and other partners, which enhances coordination and communication across the supply chain network. This interconnectedness allows companies to share information, resources and risks more efficiently, increasing their capacity to anticipate and mitigate potential disruptions (Chopra & Meindl 2019; Kumar & Teixera 2018). The importance of supply chain integration in business management has witnessed a burgeoning interest from practitioners and academicians (see Ambulkar, Blackhurst & Grawe 2015; Juan, Li & Hung 2022; Kaliani Sundram, Chandran & Awais Bhatti 2016; Khanuja & Jain 2020; Tiwari 2021).

Past research argues that supply chain integration is beneficial to businesses. According to Rahman, Sarker and Essam (2020), supply chain integration enables businesses to enhance their resilience and effectively respond to disruptions and uncertainties in the market. Other authors, such as Kachroudi, Charfi and Siadat (2019), noted that companies can create a seamless flow of goods and information by integrating various aspects of the supply chain, such as suppliers, manufacturers, distributors and retailers. This integration allows for better coordination, communication and

collaboration among all parties involved, improving efficiency and effectiveness in operations (Al-Tarawneh, Madanat & Al Abbadi 2019).

The integration of supply chains has its fair share of challenges. One significant factor is the limited technological infrastructure in many African countries, which poses challenges for companies looking to implement complex supply chain systems (Chikweche & Ntuli 2020). Additionally, inadequate resources, both financial and human, play a role in impeding the integration process (Chikweche & Ntuli 2020). Many African companies need more budgets and skilled personnel to implement and manage integrated supply chains (Das & Ahmed 2020). Furthermore, a lack of awareness about the benefits and potential competitive advantages of supply chain integration may also contribute to the slower uptake of these strategies in African retail companies (Ntuli & Chikweche 2020). Educating stakeholders about the positive impacts of supply chain integration on efficiency, cost reduction and customer satisfaction could help bridge this awareness gap and drive further adoption in the future (Ntuli & Chikweche 2019).

The advent of the fourth industrial revolution has cemented the central role of supply chain integration in business. Companies can use advanced technologies and data analytics to optimise inventory management, minimise stockouts and improve forecasting accuracy (Ivanov & Dolgui 2020). Studies have indicated that a significant percentage of retail companies in Western countries have embraced supply chain integration, with up to 80% implementing some integration strategy to maintain agility and competitiveness in the current fast-paced market environment (Lee & Tang 2017). From the Global South perspective, African countries such as South Africa, Kenya and Nigeria have seen a gradual increase in the adoption of supply chain integration (see Chikweche & Ntuli 2020). However, despite the steady rise in supply chain integration in Africa, the adoption rate of supply chain integration strategies remains relatively lower compared to Western nations. For example, Ntuli and Chikweche (2021) noted that approximately only 40% of retail companies are actively implementing supply chain integration practices. This calls for more research on this concept in developing countries such as Namibia. It is against this background that this study focusses on the impact of supply chain integration on the resilience of state-owned logistics enterprises in Namibia.

This study yields significant contributions, both for academicians and practitioners. Firstly, it addresses frequent calls for further research on supplier integration in the Global South firms where the concept is still embryonic (see Ntuli & Chikweche 2021). Secondly, this study extends the existing supply chain integration body of literature by examining the link between supply chain integration practices and a firm's resilience in the logistics business. From a practical perspective, the results of this study can offer important insights for effective decision-making among logisticians. The rest of the article is organised as follows:

The literature review section is followed by, theoretical underpping, then hypotheses development, follwed by methodology, results and discussion. After this there are sections on theoretical implication and practical implication and finally, the conclusion.

Literature review
Supply chain integration

The coordination and cooperation of different organisations within a supply chain network to increase productivity, lower expenses and improve customer satisfaction is known as supply chain integration (Chopra & Meindl 2019). From suppliers of raw materials to final consumers, it entails the smooth transfer of data, goods and resources at every level of the supply chain (Monczka et al. 2018). Organisations can improve overall performance, visibility and responsiveness by integrating various activities and processes throughout the supply chain (Ivanov & Dolgui 2019).

Supply chain resilience

The capacity of a supply chain to foresee, plan for, respond to and recover from interruptions in order to continue functioning effectively and efficiently is referred to as supply chain resilience (Christopher & Ryals 2014). It entails being able to endure and bounce back from various shocks, including natural catastrophes, international conflicts, economic downturns and technical setbacks (Ivanov & Dolgui 2019). According to Narassima et al. (2024), a resilient supply chain can minimise the effects of disruptions, swiftly adjust to changing conditions and continue operating without experiencing major disruptions.

Theoretical underpinning

This study is based on the supply chain integration model. The supply chain integration model is shown in this section.

Supply chain integration model

The supply chain integration model is a concept developed and refined by Martin Christopher and Towill (2001). The supply chain integration model provides a framework for understanding how different components of a supply chain can be integrated to improve overall performance and responsiveness (Figure 1). It emphasises the importance of collaboration, coordination and information sharing among various stakeholders in the supply chain (Lee & Severance 2017). These variables underpin the conceptual framework of this study; hence, the supply chain integration model assumes significant relevance. By integrating its supply chain, the Namibian Port Authority can establish stronger relationships with suppliers, distributors and other partners, enhancing resilience in the face of disruptions or uncertainties. Through strategic alignment, the Namibian Port Authority can ensure that all stakeholders in the supply chain have a shared understanding of goals and objectives. This alignment enables coordinated responses during challenging situations,
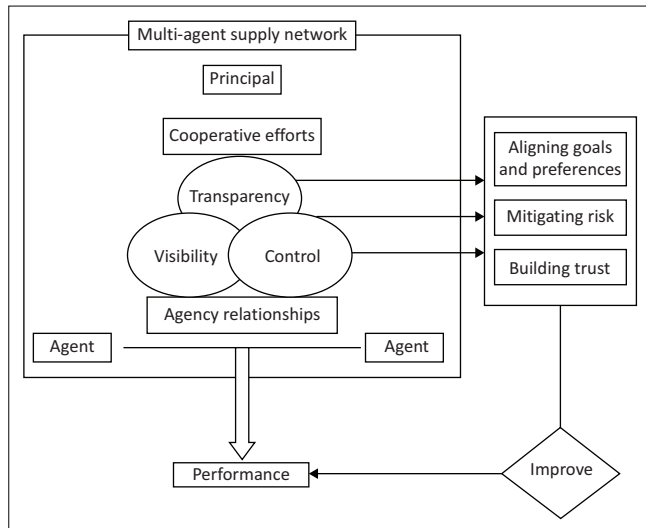
Source: Christopher, M. & Towill, D., 2001, 'An integrated model for the design of agile supply chains', *International Journal of Physical Distribution & Logistics Management* 31(4), 235–246. https://doi.org/10.1108/09574090410700275

FIGURE 1: Supply chain integration model.

contributing to the company's resilience. Process integration allows the Namibian Port Authority to streamline operations, improve efficiency and quickly adapt to changing market conditions. Information sharing, another supply chain integration model dimension, plays a vital role in building resilience (Han 2018). The Namibian Port Authority can access the supply chain by implementing robust information systems and sharing real-time data with partners. This visibility enables proactive identification of potential bottlenecks, effective demand forecasting and better decision-making during disruption (Dolgui, Ivanov & Sokolov 2018).

Hypotheses development
Supplier integration and supply chain resilience

Researchers and practitioners alike have been interested in the connection between supplier integration and supply resilience. Several studies have highlighted the importance of supplier integration in enhancing supply chain resilience (Pagell & Wu 2019). By closely aligning with suppliers, companies can improve their responsiveness to changes in demand, mitigate risks and build a more robust supply chain network (Singh et al. 2019). Information sharing is a crucial aspect of supplier integration that contributes to supply resilience. According to Wagner and Bode (2020) and Sen Gupta (2020), companies collaborating with their suppliers to create contingency plans can better anticipate potential disruptions. This proactive approach enables companies to adapt quickly to unforeseen events and maintain continuity in their operations.

Furthermore, supplier integration fosters trust and collaboration between partners, which is essential for building resilient supply chains (Choi & Krause 2019). By establishing solid relationships with suppliers based on trust and transparency, companies can navigate challenges more effectively and recover swiftly from disruptions. Research has shown that companies prioritising supplier integration tend to exhibit higher levels of supply chain resilience

than those that do not emphasise such partnerships (Ivanov & Dolgui 2019). This positive impact underscores the importance of fostering strong ties with suppliers as a strategic approach to enhancing overall supply chain performance. It can, therefore, be proposed that:

> **H1:** Supplier integration positively influences the supply chain resilience.

Internal integration and supply chain resilience

Internal integration and supply chain resilience are crucial aspects of a company's operations, particularly in retail. Internal integration refers to aligning internal functions within a company to streamline processes and enhance overall efficiency (Shekarian & Mahour Mellat Parast 2021). On the other hand, supply chain resilience is the ability of a company to adapt and recover from disruptions in the supply chain quickly (Yusuf et al. 2019). Numerous studies have highlighted the importance of internal integration in enhancing supply chain resilience. For instance, research conducted on Taiwanese third-party logistics (3PLs) companies demonstrated that internal integration positively impacted supply chain partnerships with external entities such as customers and logistics collaborators. This suggests that a well-integrated internal system can lead to stronger external relationships, essential for building resilience in the face of challenges (Yusuf et al. 2020).

Similarly, studies focussing on manufacturing companies in Malaysia have shown that internal integration significantly influences supply chain resilience. By aligning business information systems and fostering collaboration at both structural and social levels, companies can enhance their organisational agility and better respond to disruptions in the supply chain (Seyedhoseini, Hojabri & Seyedhoseini 2020). Moreover, information systems utilised by companies to manage demand, synchronise operations and control processes have been found to increase overall supply chain agility (Zhang, Zhang & Chen 2020). This agility is crucial for ensuring that companies can quickly adapt to changing market conditions and unforeseen events, such as those experienced during the coronavirus disease 2019 (COVID-19) pandemic. The relationship between internal integration and supply chain resilience has also been linked to improved organisational performance and sustainable competitive advantages. Companies that effectively integrate their internal functions and collaborate with external partners tend to outperform their competitors by responding more swiftly to disruptions and meeting customer demands efficiently (Yusuf et al. 2020). It can, therefore, be hypothesised that:

> **H2:** There is a positive relationship between internal integration and supply chain resilience.

Customer integration and supply chain resilience

Customer integration is a strategic approach that actively involves customers in various supply chain stages, such as

product design, demand forecasting and order fulfilment. This collaborative process fosters information sharing and joint decision-making between retail companies and their customers (Ghobakhloo & Tang 2019). By integrating customers into the supply chain, companies gain valuable insights into customer demand patterns, preferences and emerging trends (Yang, Zhang & Jiang 2020). This knowledge enables them to align their operations more effectively with customer requirements, resulting in improved responsiveness, reduced lead times and enhanced customer satisfaction (Castelli & Perego 2019).

Supply chain resilience refers to a company's ability to anticipate and effectively respond to disruptions, ensuring the continuity of operations and minimising negative impacts (Goetzke & Wagner 2018). Resilient supply chains can quickly identify and assess disruptions, develop contingency plans and adapt to changing circumstances (Gligor & Holcomb 2019). Extensive research has demonstrated that supply chain resilience positively impacts a company's operational performance, customer satisfaction and financial performance (Song et al. 2022; Gligor, Holcomb & Bozkurt 2019). Resilient supply chains are better equipped to handle disruptions such as natural disasters, supplier failures or demand fluctuations.

The integration of customers into the supply chain has emerged as a strategic approach to enhance supply chain resilience within the retail industry (Goetzke & Wagner 2018). Companies gain real-time demand information by involving customers in supply chain processes to align their production and distribution activities accordingly. Customer integration facilitates improved demand forecasting, enhanced order visibility and increased responsiveness to customer needs. Notably, Holloway (2024) found that customer integration positively influences supply chain flexibility and agility, critical components of resilience. It can, therefore, be hypothesised that:

> **H3:** Customer integration positively influences supply chain resilience.

Information sharing and supply chain resilience

Information sharing is critical to enhancing supply chain resilience for companies operating in various industries, including retail. The exchange of timely and accurate information among supply chain partners can significantly impact the ability of organisations to anticipate, respond to and recover from disruptions effectively (Lee & Severance 2017). Information sharing is critical for enhancing supply chain resilience because it facilitates improved coordination, visibility and decision-making throughout the supply chain network, according to several studies (Wang & Zhang 2019).

Research by Lee and Severance (2017) emphasised that information sharing among supply chain partners can lead to increased transparency and collaboration, which is essential for building resilient supply chains. By sharing relevant data

on demand forecasts, inventory levels, production schedules and potential risks, companies can enhance their ability to detect disruptions early and implement proactive measures to mitigate their impact. Similarly, a study conducted by Wang and Zhang (2019) demonstrated that effective information-sharing mechanisms contribute to faster response times during supply chain disruptions. Real-time data exchange allows companies to make informed decisions quickly, allocate resources efficiently and maintain operational continuity even in challenging circumstances.

Furthermore, research by Chen, Yang and Zhou (2020) explored the relationship between information-sharing practices and supply chain resilience in the context of retail companies. The findings indicated that organisations with robust information-sharing processes were better equipped to adapt to changing market conditions, collaborate with suppliers and distributors effectively and recover swiftly from disruptions. It can thus be hypothesised that:

> **H4:** Information sharing positively influences supply chain resilience.

As mentioned earlier in this discussion, this study formulates the conceptual framework presented in Figure 2.

Methodology
Respondents

This study conveniently surveyed 280 respondents from the Namibian Port Authority. The structured questionnaire was developed using Google Forms. A link with the questionnaire was created and sent to the respondents' email addresses and mobile phones.

Research instrument measures

Validated items were used to measure the research constructs. Measurement items for supplier integration, internal integration, customer integration and information sharing were adapted from Flynn, Huo and Zhao (2010). Supply chain resilience was measured on a five-point Likert scale, with measurement items as suggested by Juan et al. (2022).

Ethical considerations

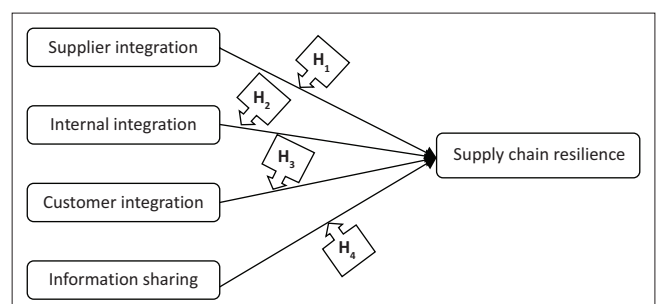Ethical clearance to conduct this study was obtained from the University of KwaZulu-Natal Humanities and Social

FIGURE 2: Conceptual framework.

Sciences Research Ethics Committee (HSSREC) (reference no.: HSSREC/00003545/2021).

Results

Reliability and validity

The reliability and validity of the data were assessed using indicator reliability, Cronbach's alpha, average variance extracted (AVE), composite reliability (CR) and discriminant validity, as described in this section.

Indicator reliability

Reflective indicator loadings greater than 0.5 show that the item is a good measurement of a latent construct (see Hulland 1999). Accordingly, all the indicator loadings exceeded 0.5 (see Table 1).

Internal consistency reliability

Composite reliability and Cronbach's alpha (α) can be used to assess internal consistency reliability. Gefen, Straub and Boudreau (2000) state that a CR value of at least 0.7 indicates adequate internal consistency reliability. Hair, Hult and Ringle (2017) suggested that Cronbach alpha (α) values between 0.60 and 0.70 are widely considered desirable in

research to indicate internal consistency reliability. As shown in Table 1, all the constructs satisfied the Cronbach alpha and CR threshold values.

Convergent reliability

Convergent reliability is the extent to which a measure correlates positively with alternative measures of the same construct (Hair et al. 2017). Convergent reliability is assessed using the AVE. The AVE should be greater than 0.5 (see Bagozzi 1989; Hair et al. 2016). The AVE for all the constructs in this study was greater than 0.5 (see Table 1); thus, the measurement scales showed good convergent reliability.

Discriminant validity

Discriminant validity was assessed using the Fornell-Larcker criterion (see Hair et al. 2016). The Fornell–Lacker criterion compares the square root of the AVE values with the latent variable correlations with other constructs. The square root of the AVE of each construct should be higher than the correlation with any other construct (Hair et al. 2016). The square root of the AVE of each latent variable is shown diagonally in bold in Table 2, along with the correlations of the latent variable with other latent variables. Table 2 indicates that the square root of the AVE of each

TABLE 1: Questionnaire items, factor loadings, means, standard deviation cronbach values, average variance extracted and composite reliability.

Item code	Variable	Factor loading	Alpha	AVE	CR
-	**Supplier integration**	-	0.80	0.54	0.85
SI1	There is extensive participation of our major suppliers in the process of procurement and production	0.65	-	-	-
SI2	The level of information exchange with our primary supplier through information networks is very high	0.69	-	-	-
SI3	There are existing strategic partnerships with our major suppliers	0.76	-	-	-
SI4	Our primary supplier shares their production schedule with us	0.82	-	-	-
SI5	We share our demand forecasts with our major suppliers	0.75	-	-	-
-	**Internal integration**	-	0.75	0.68	0.92
II1	The use of cross-functional teams in process improvement and product development is prominent in this organisation	0.71	-	-	-
II2	In this organisation, there is data integration among internal functions	0.85	-	-	-
II3	In this organisation, there is enterprise application integration among internal functions	0.90	-	-	-
II4	This organisation's utilisation of periodic interdepartmental meetings among internal functions is very high	0.81	-	-	-
II5	This organisation has real-time integration and connection among all internal functions, from raw material management through production, shipping and sales	0.87	-	-	-
-	**Customer integration**	-	0.79	0.57	0.87
CI1	We have linkages with our major customers through information networks	0.85	-	-	-
CI2	We are connected with our major customers through computer networks	0.53	-	-	-
CI3	Our major customers share demand forecast information with us	0.81	-	-	-
CI4	We have established quick ordering systems with our customers	0.74	-	-	-
CI5	The level of communication with our major customers is very high	0.81	-	-	-
-	**Information sharing**	-	0.77	0.57	0.88
IN1	Our trading partners share proprietary information with us	0.62	-	-	-
IN2	Our trading partners keep us fully informed about issues that affect business	0.78	-	-	-
IN3	Our trading partners share business knowledge of core business processes with us	0.85	-	-	-
IN4	Information exchange between our organisation and the trading partners is adequate	0.72	-	-	-
IN5	Information exchange between our organisation and the trading partners is accurate	0.78	-	-	-
-	**Supply chain resilience**	-	0.76	0.57	0.89
SR1	We can cope with changes brought about by the disruption of the supply chain	0.85	-	-	-
SR2	We can adapt to the supply chain disruption quickly	0.56	-	-	-
SR3	We can provide a quick response to the supply chain disruption	0.82	-	-	-
SR4	We reconfigure our resources and processes in response to the dynamic environment	0.89	-	-	-
SR5	We renew our resource base in response to the changing business environment	0.77	-	-	-
SR6	We can maintain high situational awareness at all times	0.57	-	-	-

AVE, average variance extracted; CR, composite reliability.

latent variable is indeed higher than any correlation with any other latent variable. Thus, the measurement instrument satisfied discriminant validity.

Confirmatory factor analysis

The suitability of data for factor analysis was assessed using the Kaiser–Meyer–Olkin (KMO) and Bartlett's test of sphericity. The KMO value was 0.89, above the minimum recommended value of 0.5 (Hair et al. 2017). In addition, Bartlett's sphericity was significant at $p = 0.000$, rendering the sample adequate for factor analysis.

In assessing the model, the researchers used the following model fit indices: chi-square minimum (CMIN), incremental fit index (IFI), comparative fit index (CFI) and the root mean square error of approximation (RMSEA). After running the

confirmatory factor analysis for the model, the results indicated that the model was good because it produced results that were within acceptable limits (see Hair et al. 2016). The model fit indices obtained from the confirmatory factor analysis are CMIN = 1.66; $p = 0.000$; IFI = 0.92; CFI = 0.91; RMSEA = 0.08.

Structural equation modelling

Structural equation modelling (SEM) analysis was conducted using Amos version 26 to test the hypotheses of this study (Figure 3). As shown in Table 3, all model fit values were within the acceptable range.

Direct effects

As indicated in Table 3, supplier, internal, customer and information sharing significantly impacted supply chain resilience (β = 0.17, $p = 0.00$; β = 0.31, $p = 0.00$; β = 0.21, $p = 0.00$;

TABLE 2: Discriminant validity.

Variable	Supplier integration	Internal integration	Customer integration	Information integration	Supply chain resilience
Supplier integration	**0.73**†	-	-	-	-
Internal integration	0.67	**0.82**†	-	-	-
Customer integration	0.65	0.71	**0.75**†	-	-
Information integration	0.65	0.70	0.71	**0.75**†	-
Supply chain resilience	0.68	0.78	0.69	0.70	**0.75**†

†, The discriminant validity values. Emphasis added to indicate the square root of the AVE of each latent variable.

TABLE 3: Path coefficients and probability values.

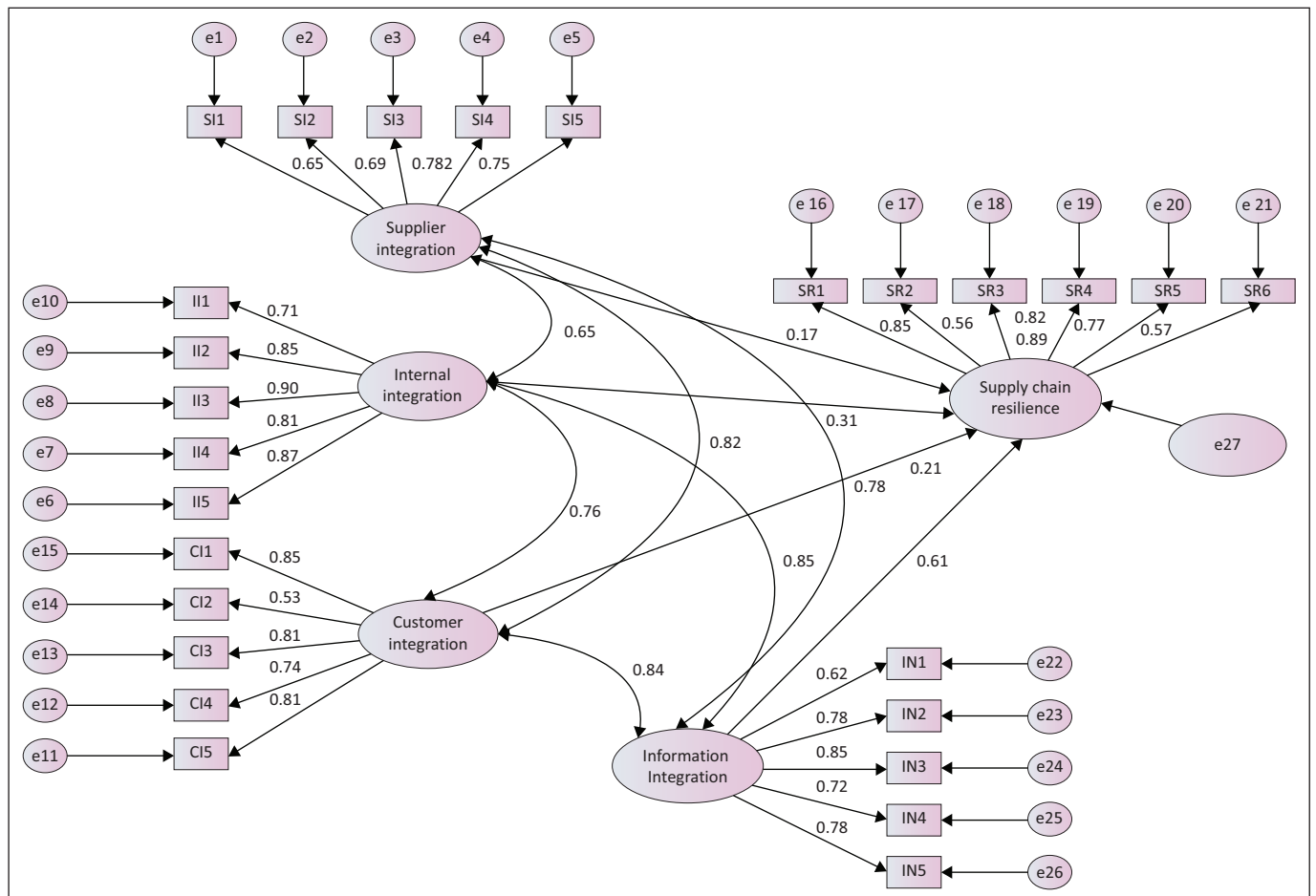| Hypothesis	Path	Path coefficient	p	Decision
H1	Supplier integration > supply chain resilience	0.17	0.00	Accepted
H2	Internal integration > supply chain resilience	0.31	0.00	Accepted
H3	Customer integration > supply chain resilience	0.21	0.00	Accepted
H4	Information sharing > supply chain resilience	0.61	0.00	Accepted

FIGURE 3: Structure equation modelling.

$\beta = 0.61$, $p = 0.00$, respectively). Hence *H1, H2, H3 and H4* were accepted.

Discussion

The study sought to examine supply chain integration variables that influence the supply chain's resilience. This study provides several viewpoints. Firstly, supplier integration was found to have a positive and significant impact on supply chain resilience ($\beta = 0.17$; $p < 0.05$). Prior studies support the findings of this study (see Ivanov & Dolgi 2019). Supply chain resilience is enhanced if an organisation collaborates closely with its suppliers. The responsiveness to changes in demand and risk mitigation can be improved with integration with suppliers. It is possible to create contingency plans if an organisation works closely with the suppliers.

Secondly, internal integration was also found to have a significant relationship with supply chain resilience ($\beta = 0.31$; $p < 0.05$). This result resonates with the work of authors such as Yusuf et al. (2020) and Seyedhoseni et al. (2020). In the context of this study, this finding implies that the alignment of internal functions within a company can facilitate the streamlining of processes and enhance the overall efficiency of the business. A well-integrated internal system can influence the development of stronger external relationships, which are essential for building resilience in the face of obstacles. Thirdly, as hypothesised, customer integration was found to have a positive relationship with supply chain resilience ($\beta = 0.21$; $p < 0.05$). These findings corroborate the work of Castelli and Perego (2019) and Goetzke and Wagner (2018). Suppose customers are included in the supply chain decision-making processes, in that case, organisations can get real-time demand information to align their production and distribution activities, thus building a resilient supply chain. Supply chain disruptions can, therefore, be avoided. Fourthly, the study results showed that information sharing impacted supply chain resilience positively ($\beta = 0.61$; $p < 0.05$). When information is shared, coordination, visibility and decision-making throughout the supply chain network can be improved. This facilitates the development of a resilient supply chain. A resilient supply chain can be developed if data on demand forecasts, inventory levels and production are shared.

Theoretical implications

The results of this study contribute to the literature on supply chain integration in several ways.

Previous research stresses the need to investigate African supply chain integration practices (Ntuli & Chikweche 2021). This study is, therefore, a response to this call as it investigated the nexus between supply chain integration practices and resilience. Many authors have investigated the concept of supply chain integration practices (see Ambulkar et al. 2015; Flynn et al. 2010; Juan et al. 2022; Kaliani Sundram et al. 2016; Khanuja & Jain 2020; Tiwari 2021).

However, these studies are mainly global north context based. The applicability of their research results may, therefore, vary in context. With this in mind, this investigation is significant as it contributes to the body of literature from a Global South perspective. Lastly, this study has validated the link between selected supply chain integration practices (supplier integration, internal integration, customer integration and information sharing) and supply chain resilience. These findings can act as a basis for future research.

Practical implications

In addition to making significant contributions to the literature, this study also has important practical implications. Study findings imply that logistics managers should pay attention to antecedents of supply chain resilience, which were validated in this research. Supplier, internal, customer and information sharing were positively associated with supply chain resilience. Logistics managers must integrate business systems to improve the overall efficiencies of businesses. For example, technology systems can be integrated, facilitating information sharing throughout the network of business partners.

Conclusion

This investigation focussed on the effect of supply chain integration mechanisms on the resilience of supply chains. In doing so, the researchers have contributed to studying an important Namibian supply chain landscape concept. Little is known about supply chain integration mechanisms in the Namibian context; hence, this study is a solid foundation for future studies. The findings generally revealed that all the variables under study significantly impacted supply chain resilience. This highlights the critical importance of antecedents that can build resilient supply chains. Hence, this study provides fascinating insights into Namibia's supply chain landscape.

Acknowledgements

Competing interests

The authors declare that they have no financial or personal relationships that may have inappropriately influenced them in writing this article.

Authors' contributions

A.T.S and P.T.M. contributed equally to this work.

Funding information

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Data availability

Data sets analysed during the current study are available from the corresponding author, A.T.S., upon reasonable request.

Disclaimer

The views and opinions expressed in this article are those of the authors and are the product of professional research. It does not necessarily reflect the official policy or position of any affiliated institution, funder, agency or that of the publisher. The authors are responsible for this article's results, findings and content.

References

AI-Tarawneh, H.A., Madanat, S. & Al Abbadi, A.A., 2019, 'The impact of supply chain integration on supply chain resilience', *International Journal of Logistics Systems and Management* 33(1), 1–23.

Ambulkar, S., Blackhurst, J. & Grawe, S., 2015, 'Firm's resilience to supply chain disruptions: Scale development and empirical examination', *Journal of Operations Management* 33–34(1), 111–122. https://doi.org/10.1016/j.jom.2014.11.002

Bagozzi, R.P., 1989, 'Attitude formation is under the theory of reasoned action and purposeful behaviour reformulation', *British Journal of Social Psychology* 25(2), 95–107. https://doi.org/10.1111/j.2044-8309.1986.tb00708.x

Castelli, C.M. & Perego, A., 2019, 'The impact of customer integration on supply chain integration and performance: Evidence from the food industry', *Supply Chain Management: An International Journal* 24(2), 282–299.

Chen, H., Yang, Y. & Zhou, H., 2020, 'Information sharing and supply chain resilience: The mediating role of supply chain visibility', *Journal of Risk Research* 23(7), 947–964.

Chikweche, T. & Ntuli, F., 2020, 'Supply chain integration and firm resilience in the retail sector: The mediating role of supply chain agility', *African Journal of Economic and Management Studies* 10(4), 474–495.

Choi, T.Y. & Krause, D.R., 2019, 'Supplier integration and firm performance: A meta-analysis of indirect effects', *Journal of Supply Chain Management* 56(3), 30–50.

Chopra, S. & Meindl, P., 2019, *Supply chain management: Strategy, planning and operation*, 7th edn., Operation Management.

Christopher, M. & Peck, H., 2018, 'Building the resilience supply chain', *International Journal of Logistics Management* 15(2), 1–14. https://doi.org/10.1108/09574090410700275

Christopher, M. & Ryals, L.J., 2014, 'The supply chain becomes the demand chain', *Journal of Business Logistics* 35(1), 29–35. https://doi.org/10.1111/jbl.12037

Christopher, M. & Towill, D., 2001, 'An integrated model for the design of agile supply chains', *International Journal of Physical Distribution & Logistics Management* 31(4), 235–246. https://doi.org/10.1108/09574090410700275

Das, K. & Ahmed, R., 2020, 'Supply chain integration and firm resilience: The mediating role of supply chain flexibility', *International Journal of Logistics Systems and Management* 35(2), 201–225.

Dolgui, A., Ivanov, D. & Sokolov, B., 2018, 'Ripple effect in the supply chain: An analysis and recent literature', *International journal of production research*, 56(1–2), 414–430.

Flynn, B.B., Huo, B. & Zhao, X., 2010, 'The impact of supply chain integration on performance: A contingency and configuration approach', *Journal of Operations Management* 28(1), 58–71. https://doi.org/10.1016/j.jom.2009.06.001

Gefen, D., Straub, D. & Boudreau, M., 2000, 'Structural equation modeling and regression: Guidelines for research practice', *Communications of the Association for Information Systems* 4. https://doi.org/10.177705/1CAIS.00407

Ghobakhloo, M. & Tang, S.H., 2019, 'Customer integration in new product development and its impact on product innovativeness and market performance: The mediating role of supply chain integration', *Industrial marketing management* 81, 206–217.

Gligor, D.M. & Holcomb, M.C., 2019, 'Customer integration in supply chains: An overview of the current state of knowledge', *Journal of Business Logistics* 40(1), 70–85.

Gligor, N., Holcomb, M., & Bozkurt, S., 2019, 'Distinguish between the concepts of supply chain agility and resilience: A multidisciplinary literature review', *The international Journal of Logistics Management* 30(2), 467–487b.

Goetzke, B. & Wagner, S.M., 2018, 'The impact of customer integration and supply chain integration on performance: A contingency and configurational approach', *Journal of Business Logistics* 39(3), 213–229.

Hair Jnr, J.F., Hult, G.T.M. & Ringle, C., 2017, *A primer on partial least squares structural equation modelling (PLS-SEM)*, Sage, Thousand Oaks, CA.

Hair, Jr. J.F., Sarstedt, M., Mathews, L.M. & Ringlr, C.M., 2016, 'Identifying and treating unobserving heterogeneity with FIMIX-PLS: Part I-method', *European Business Review* 28(1), 63–76. https://doi.org/10.1108/EBR-09-2015-0094

Han, C.H., 2018, 'Assessing the impacts of port supply chain integration on port performance', *The Asian Journal of Shipping and Logistics* 34(2), 129–135.

Holloway, S., 2024, *The synergy between supply chain agility and marketing flexibility: A qualitative study of adaptation strategies in turbulent markets*, viewed 03 August 2024, from https://doi.org/10.20944/preprints202406.1825.v1

Hulland, J., 1999, 'Use of partial least squares (PLS) in strategic management research: A review of four recent studies', *Strategic Management Journal* 20(2), 195–204.

Ivanov, D. & Dolgui, A., 2019, 'A digital supply chain twin for managing the resilience and sustainability of supply chains', *International Journal of Production Research* 57(8), 1–18.

Ivanov, D. & Dolgui, A., 2020, 'A digital supply chain twin for managing the disruption risks and resilience in the era of Industry 4.0', *Production Planning & Control* 32(9), 775–788. https://doi.org/10.1080/0953728.2020.1768450

Juan, S.J., Li, E.Y. & Hung, W.H., 2022, 'An integrated model of supply chain resilience and its impact on supply chain performance under disruption', *International Journal of Logistics Management* 33(1), 339–364. https://doi.org/10.1108/IJLM-03-2021-0174

Kachroudi, M., Charfi, F. & Siadat, A., 2019, 'Supply chain integration and resilience: A systematic literature review', *International Journal of Production Economics* 210, 107–124.

Kaliani Sundram, V.P., Chandran, V.G.R. & Awais Bhatti, M., 2016, 'Supply chain practices and performance: The indirect effects of supply chain integration', *Benchmarking* 23(6), 1445–1471. https://doi.org/10.1108/BIJ-03-2015-0023

Khanuja, A. & Jain, R.K., 2020, 'Supply chain integration: A review of enablers, dimensions and performance', *Benchmarking: An International Journal* 27(1), 264–301. https://doi.org/10.1108/BIJ-07-2018-0217

Kumar, A. & Teixera, R.F., 2018, 'The impact of supply chain integration on operational performance: A contingency and configuration approach', *International Journal of Production Economics* 204, 160–173.

Lee, H.L. & Tang, C.S., 2017, 'Resilience and disruption management in supply chains', *Production and Operations Management* 26(7), 1240–1255.

Lee, S.M. & Severance, D., 2017, 'Relationship between information sharing and supply chain resilience: Moderating', *Journal of Production Research* 55(5), 1473–1490.

Narassima, M.S., Gedam, V., Gunasekaran, A., Anbuudayasankar, S.P. & Dwarakanath, M., 2024, 'A novel coexistent resilience index to evaluate the supply chain resilience of industries using fuzzy logic', *Supply Chain Management: An International Journal* 29(2), 221–243.

Ntuli, F. & Chikweche, T., 2019, 'Supply chain integration and firm resilience in the retail sector: The mediating role of supply chain agility', *African Journal of Economic and Management Studies* 10(4), 474–495.

Ntuli, F. & Chikweche, T., 2021, 'Supply chain integration and resilience in the retail sector: A case study of selected retailers in South Africa', *International Journal of Retail & Distribution Management* 49(10), 1333–1352.

Monczka, R.M., Handfield, R.B., Giunipero, L.C. & Patterson, J.L., 2018, *Purchasing and supply chain management*, Cengage Learning, Boston, MA.

Ntuli, F. & Chikweche, T., 2020, 'The impact of supply chain integration on retail firm resilience: Empirical evidence from the South African retail sector', *Journal of Economics and Behavioral Studies* 12(6), 1–15.

Pagell, M. & Wu, Z., 2019, 'Building a more resilient supply chain', *MIT Sloan Management Review* 60(3), 45–51.

Rahman, S.U., Sarker, B.R. & Essam, D.L., 2020, 'Supply chain integration and resilience: A systematic literature review and research agenda', *International Journal of Production Research* 58(3), 691–729.

Sen Gupta, B., 2020, *Supply chain disruption & Plausible solution in the scenario of COVID-19 pandemic; forging a pandemic adaptive supply chain*, Master's thesis, Tampere University.

Seyedhoseini, S.M., Hojabri, F. & Seyedhoseini, S.M., 2020, 'The impact of internal integration on supply chain agility', *International Journal of Production Research* 58(2), 313–331.

Shekarian, M. & Mahour Mellat Parast, M., 2021, 'An integrative approach to supply chain disruption risk and resilience management: A literature review', *International Journal of Logistics Research and Applications* 24(5), 427–455. https://doi.org/10.1108/13675567.2020.1763935

Shooya, A.T., 2023, 'Impacts of supply chain integration on resilience in state-owned logistics enterprises in Namibia', PhD thesis, School of Management, IT & Governance College of Law and Management Studies, University of Kwazulu-Naltal.

Singh, P., Kaur, A. & Bishnoi, V.K., 2019, 'Impact of information sharing, collaboration and trust on vendor–buyer relationship', *Small Enterprises Development, Management & Extension Journal* 46(3), 179–188. https://doi.org/10.1177/0970846419863872

Song, M., Ma, X., Zhao, X. & Zhang, L., 2022, 'How to enhance supply chain resilience: A logistics approach', *The International Journal of Logistics Management* 33(4), 1408–1436. https://doi.org/10.1108/IJLM-04-2021-0211

Tiwari, S., 2021, 'Supply chain integration and Industry 4.0: A systematic literature review', *Benchmarking: An International Journal* 28(3), 990–1030. https://doi.org/10.1108/BIJ-08-2020-0428

Wagner, S.M. & Bode, C., 2020, 'Supplier integration and firm performance: A routine-based perspective', *Journal of Supply Chain Management* 56(3), 30–50.

Wang, S. & Zhang, D., 2019, 'Impact of information sharing on supply chain resilience: A dynamic capability perspective', *International Journal of Production Economics* 217, 81–92.

Yang, J., Zhang, M. & Jiang, L., 2020, 'Customer integration, information sharing, and firm performance: Evidence from China's manufacturing industry', *International Journal of Production Economics* 225, 107572. https://doi.org/10.1016/j.ijpe.2019.107572

Yusuf, Y.Y., Gunasekaran, A., Musa, A., Dauda, M. & El-Berishy, N.M., 2019, 'The UK oil and gas supply chains: Understanding the industry dynamics', *International Journal of Production Economics* 216, 183–195.

Zhang, M., Zhang, Y. & Chen, X., 2020, 'The impact of internal integration on supply chain resilience: The mediating role of supply chain agility', *Annals of Operations Research* 290(1–2), 617–635.