Enhancing supply chain information sharing with third party logistics service providers

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Abstract

Purpose – This study evaluated the enhancement of information sharing practices with third party logistics service providers (3PLs) in a supply chain solutions company that provides transport and warehousing software in Johannesburg, South Africa.

Design/methodology/approach – A mixed methods case study was conducted to investigate the problem. Both strands of quantitative and qualitative data were given equal priority. Three rounds of primary data were sequentially collected, analysed and triangulated. An online questionnaire was distributed to a sampling frame of seventeen companies which were randomly selected from the population. Three company executives were purposively sampled to participate in a focus group interview. Data from an open-ended questionnaire were used to explain and validate the findings from clients and executives who participated in the two preceding rounds of data collection.

Findings – It was found that information sharing improves the collaboration of channel members, increases competitive advantage and ultimately leads to better customer service. The improvement of relationships and continuous technological upgrades are recommended for improving visibility of information and effectiveness in the management of supply chains.

Research limitations/implications – This study is limited by the characteristics of the case study methodology. Case study research suffers from restricted generalisability, problems with cross-checking and the risk of bias and subjectivity. This implies that the results of this case study may not be generalised to the overall population. The selection of a mixed methods design was intended to curb the limitations that are inherent to this study.

Practical implications – This study was limited to a few respondents and participants, which raises concerns about both the statistical power and the generalisability of the results. However, the results provide useful insights into some of the information sharing practices in the industry.

Originality/value – The value of the study contributes to the supply chain's dependence on 3PLs for value creation and the reliance on technology to share information amongst channel members. This study highlights a need for organisations to build collaborative relationships with 3PLs and continuously update technological infrastructure in order to meet supply chain network goals.

Keywords Information sharing, Third party logistics service providers, Information technology, Performance measurement

Paper type Research paper

1. Introduction

The use of information in supply chain management (SCM) is acknowledged as one of the key factors in improving operations and enhancing supply chain performance. Several authors

have studied the practice of information sharing, its benefits and related risks in various industries. Kochan et al. (2018) indicated that information sharing is crucial in healthcare supply chains in order to improve inventory management and capacity planning in the sector. A strategy to implement partial information sharing among supply chain retailers in order to improve performance was developed by Dominguez et al. (2018). Chen and Huan (2021) indicated a need for information sharing in the re-manufacturing industry in order to track end-of-life products. In addition, sharing information was found to be highly significant in reverse logistics, since it is much more complex and uncertain than forward logistics (Wijewickrama et al., 2021). These studies suggest that, irrespective of the industry, information sharing is considered vital for improving performance in supply chain management. There are well-founded studies about information sharing in SCM. However, limited studies have focused on the practice of sharing information with third party logistics service providers (3PLs). The African Development Bank (2019) proposed that the limited attention to 3PL studies in South Africa might be attributed to the country's slow technological and infrastructural development.

Van Staden et al. (2020) defined 3PLs as integrators between suppliers, manufacturers and retailers that provide product movement and logistics information flow throughout the supply chain. Niemann et al. (2017) regarded 3PLs as external independent firms that provide integrated logistics services such as warehousing, transportation, distribution and financial services (Karrapan et al., 2017). Moyo (2021) added that 3PLs handle important logistics services such as packaging, warehousing, fulfilment and distribution of the product or service to the final customer. The activities provided by 3PLs are considered vital undertakings for achieving success in the supply chain and, as such, 3PLs have been regarded as an important success factor for supply chains globally and across sectors (Nel et al., 2018). Karrapan et al. (2017) cited cost savings, access to the best information systems and a range of value-added services, such as improved customer service levels, increased operational flexibility and the opportunity to focus on core competencies, as some of the reasons that drive South African supply chains into outsourcing services to 3PLs.

Considerable literature on information sharing with supply chain members tends to refer to upstream and downstream partners rather than 3PLs. According to Armstrong and Associates Inc (2020), 3PLs made a 10.9% contribution towards South Africa's gross domestic product (GDP). This is indicative of the imperative role of 3PLs in supply chains. Van Staden et al. (2020) argued that supply chain partners are interdependent and that a supply chain's success may be attributed to the activities that are provided by 3PLs. As such, the use of 3PLs is considered to be a critical success factor for supply chains across industries and around the globe. Wang et al. (2016) argued that, in literature, 3PLs have received limited attention in terms of their value to SCM. Third party logistics service providers are often categorised as supporting structures in SCM and their strategic importance in value creation is often overlooked (Wang et al., 2016). Giri and Sarker (2017) indicated that 3PLs play a vital role in SCM. Sharing information with 3PLs allows supply chains to analyse data in order to make informed decisions that will ultimately lead to an improved competitive advantage for the entire supply chain network (Moyo, 2021).

The visibility of information has been a challenge for 3PLs that exist within South African supply chains (Bothma et al., 2014). Vermeulen et al. (2019) define visibility as a supply chain's ability to view its activities from downstream suppliers through to final consumers. Studies by Dominguez et al. (2018), Kochan et al. (2018) and Mathu (2019) found that the complexity of dealing with too many networks ultimately means that organisations with limited levels of information suffer impaired visibility of their supply chain operations. The McKinsey Global Institute (2020) indicated that large organisations were lacking in information visibility as a result of their many tiers of participating suppliers. Information visibility is necessary for organisations to realise the benefits that can lead to SCM effectiveness and efficiency.

Various authors validated information sharing in supply chain management for improved operations and better performance. Mashiloane *et al.* (2018) proposed that sharing information between supply chain partners can increase customer value, reduce manufacturing costs and significantly improve profitability. Dominguez *et al.* (2018) asserted that information sharing provides retailers with the optimisation required by supply chain participants to make the best supply chain decisions. Raweewan and Ferrell (2018) maintained the importance of information sharing in supply chain collaboration. Huo *et al.* (2021) investigated the impact of information sharing on supply chain learning and its influences on flexibility performance. The findings revealed that information sharing facilitates knowledge sharing and close relationships for successful performance in supply chain operations (Huo *et al.*, 2021).

While the benefits are evident, considerable constraints to effective information sharing exist. Kochan *et al.* (2018) suggested that lack of knowledge of SCM practices, lack of support from senior management and organisational reluctance to new technology prevented information sharing. Colicchia *et al.* (2019) identified loss of information control, malicious attacks (such as viruses, worms and other attacks by hackers) as risks that could hinder channel members from sharing information. Other literature has deliberated issues such as accuracy, lack of trust, incompatibility, power imbalances and technological infrastructure as barriers that hinder companies from sharing information with other channel members (Panahifar *et al.*, 2018; Raweewan and Ferrell, 2018). Van Der Walt *et al.* (2021) identified these as risks that result in unwillingness to share information with other supply chain members.

Hassan and Nasereddin (2018) identified technology as a facilitator of information flow in supply chains. According to the African Development Bank (2019), the reluctance towards technological development has caused organisations to suffer the consequences of restricted and inadequate levels of information. Modgil and Sharma (2017) identified growth in inventory levels, higher costs, ineffective communication and counter-productive relationships as some of the inefficiencies suffered by supply chain companies, as a result of limited information. Chen and Huan (2021) suggested that channel partners who were not sharing information forced supply chains to operate as islands, as opposed to being part of a network. Collaboration with supply chain partners and investment in technological infrastructure, which enables organisations to track materials and inventory throughout the supply chain, is said to enhance information visibility (Vermeulen *et al.*, 2019). South African 3PLs have incomplete visibility in their supply chains, which means that they do not obtain sufficient amounts of information from their supply chain channel members.

The purpose of this paper is to evaluate the enhancement of information sharing practices with 3PLs in a supply chain solutions company. The next sections are structured as follows: the literature is reviewed in light of information sharing benefits, barriers that hinder information sharing within supply chains and the consequences suffered by organisations with limited information. The problem statement is highlighted and the methodology outlined. The study findings are discussed. The final section includes the discussion, value of the study, limitations and recommendations for future research.

2. Literature review
2.1 Information in SCM
Costantino *et al.* (2013, p. 1) defined a supply chain as "a system of suppliers, manufacturers, distributors, retailers, and customers where raw materials, finances and information flows connect participants in both directions". Information flows relate to data and knowledge that use coordinate supply chain activities and manage the flow of goods, services, and capital upstream and downstream (Huang *et al.*, 2017). Information is regarded as an essential resource that should be managed to ensure that it is received and utilised to its fullest extent

(Wijewickrama *et al.*, 2021). Researchers consider supply chains' reliance on information in order to integrate all participants, processes and activities. According to Colicchia *et al.* (2019), supply chains depend on the company's ability to access and share information in order to complete processes effectively.

Colicchia *et al.* (2019), Dominguez *et al.* (2018) and Kochan *et al.* (2018) presented supply chains as complex networks that involve multiple channel members. Wiedmer and Griffis (2021, p. 266) defined supply chain networks as "exchange relationships between suppliers, customers, and their partner firms that are necessary for manufacturing and providing goods and services to the market". According to Chopra (2019), the dynamic nature of supply chains can be attributed to constant information and resources flow between various channel members, the involvement of multiple members in a network, and the volumes of products and services moved along the chain. This interaction level may cause complexity and the need to share information with the entire supply chain network. Mashiloane *et al.* (2018) postulated that high levels of supply chain dynamism require information between firms to be shared through integrated information systems in order to disseminate information to all supply chain network participants.

2.2 Information sharing with 3PLs

Research by Jermsittiparsert and Rungsrisawat (2019) found that supply chains are still essentially driven by the practice of information sharing. Langley (2019) identified, in the annual 3PL study, effective and efficient sharing of information between channel members as the common denominator in successful relationships. Van Staden *et al.* (2020) proposed that information sharing with 3PLs is compelled by contemporary supply chains that collaborate to develop strategic relationships rather than transactional interactions. The value-creation role of 3PLs in South African supply chains has been validated by Karrapan *et al.* (2017), Niemann *et al.* (2017) and Van Der Walt *et al.* (2021). According to Karrapan *et al.* (2017), supply chains may not be able to fulfil customer demand without sharing information with third-party providers of logistics services, such as warehousing, transportation, distribution and financial services. Van Der Walt *et al.* (2021) indicated that sharing information with 3PLs allows third-party providers to complete outsourced processes, track services and provide feedback in a timely manner.

Channel members must be aware of the information type to be shared with one another so that information can be utilised effectively. Sangachhen and Vallandingham (2016) asserted that information types to be shared between channel members largely depend on the needs of the firm and the relationships between them. As such, it is imperative for supply chains to share relevant information sources so that the unique needs of the supply chain can be met. The most common types of shared information cited by Coyle *et al.* (2017), Chopra (2019) and Huang *et al.* (2017) include sales data, demand forecasts, inventory information, status of the order, delivery tracking, production schedules, performance metrics and customer information. Additionally, information qualities such as accuracy and timeliness significantly influence SCM performance (Panahifar *et al.*, 2018). Information inaccuracy may lead to poor decision-making in the supply chain (Coyle *et al.*, 2017), while delays may affect the planning and execution of supply chain processes (Nel *et al.*, 2018). Therefore, supply chains should strive to share accurate, relevant and timely information so that correct decisions can be made at the appropriate time.

Langley (2019) asserted that such information must be obtained and disseminated in real-time or near real-time in order for today's supply chains to be successful. Salam (2017) felt that achieving this frequency of information sharing requires technological mechanisms to exchange information among suppliers, customers and other partners. Mathu (2019) studied the role of information technology (IT) in information sharing within the supply chain

management of South African small and medium-sized enterprises (SMEs). The findings indicate that the application of IT in South African SMEs enhanced information sharing by improving interaction between suppliers and customers. Moyo (2021) concurred that 3PLs should actively make significant technology investments to allow them to capture, gather and analyse information.

Coyle et al. (2017) proposed that organisations invest in supply chain information systems (SCISs) that will allow channel members to share information and harness their technological ability to plan, execute and control supply chain activities in real-time. Langley (2019) revealed that common technological systems that 3PLs use to exchange information about planning and managing supply chain operations include enterprise resource planning (ERP) software, warehouse management systems (WMS), transportation management systems (TMS), supply chain visibility and WMS add-ons. It was found that the largest percentage of 3PLs was investing in WMS and TMS software (Langley, 2019). However, it was concerning that only half of 3PLs who participated in the study agreed that they were satisfied with their 3PL IT capabilities. This highlights the need for 3PLs to improve their IT capabilities, as advocated by Moyo (2021).

2.3 Benefits of sharing information
The practice of sharing information is regarded as the lifeline of the supply chain. Various authors reported on the benefits of sharing information. Highlighted benefits include enhanced collaboration (Qi et al., 2017), better relationship management (Kwon et al., 2017), accurate inventory management (Huang et al., 2017) and performance improvement (Sahin and Topal, 2019). Kwon et al. (2017) defined information sharing as the foundation for establishing relationships that foster communication, increase trust and mutually shared goals. Dominguez et al. (2017) suggested that supply chain inefficiencies can be overcome by information sharing through collaborated supply chains. According to Loury-Okoumba and Mafini (2021), collaboration calls for supply chain partners to work in a synergistic manner with the purpose of exchanging proprietary knowledge, information, expertise and technologies. Qi et al. (2017) indicated that supply chains gain competitive advantage as a result of supply chain collaboration capabilities, such as cost reduction, improved efficiency, response time and flexibility. This notion was confirmed by findings from Sahin and Topal (2019) which suggest that sharing information improves the performance of the supply chain and its competitive advantage. Gao et al. (2017) found that information sharing can increase supply chain efficiency by lowering inventory levels. When retailers share information with their suppliers, inventory uncertainty becomes reduced, as does the possibility of inventory surpluses and shortages (Huang et al., 2017). Wijewickrama et al. (2021) pointed out the crucial role of information sharing for improving the effectiveness and efficiency of supply chain activities. This efficiency can be realised through improved forecasting accuracy, enhanced customer service quality and stronger relationships between partners (Panahifar et al., 2018).

2.4 Barriers to sharing information
Panahifar et al. (2018) acknowledged that sharing information is a difficult undertaking which, with a low implementation rate within supply chains, may lead to several challenges. Researchers have attempted identifying the factors that create barriers for sharing information in the supply chain. Issues such as lack of confidentiality, trust, incompatibility, power imbalances and technological infrastructure were identified by Giri and Sarker (2017) as barriers that hinder companies from sharing information with other channel members. Technological threats such as viruses, worms and security issues were identified as risks that could prevent information sharing (Colicchia et al., 2019). A study by Gunasekaran et al. (2017) recommended that channel members choose reliable IT systems that allow integration with other members in their network so as to achieve better performance. Ali et al. (2017) studied the effects of

forecasting when information is not shared. It was found that some companies were deliberately not sharing information, due to the fear that information may be accidently leaked and accessed by competitors. As a result of this mistrust, forecasting accuracy was adversely impacted (Ali *et al.*, 2017). Hassan and Nasereddin (2018) acknowledged information leakage (unintentionally revealing confidential information with external entities) as a threat to supply chain's competitiveness. Loury-Okoumba and Mafini (2021) proposed that supply chain partners build mutual trust in order to influence all participants to freely share information and thereby build collaborative relationships.

2.5 Consequences of not sharing information
Even though the benefits of sharing information have been understood to provide a competitive advantage as a result of performance improvement and enhanced value (Dominguez *et al.*, 2017; Qi *et al.*, 2017; Sahin and Topal, 2019), reports reveal that South African companies are reluctant to share information. Previous research findings by South African organisations such as KPMG (2013), Bothma *et al.* (2014), Barloworld Supply Chain Foresight (2016) and PWC (2016) suggested that supply chains did not share critical information across all partners. Severe consequences were reported as a result of limited information sharing. KPMG (2013) found that 47% of supply chain companies cannot align real-time fluctuations in customer demand to their operations. PWC (2016) found that South African retail groups experienced efficiency issues, where their product demand exceeded supply and vice versa. These studies validate the findings of the Barloworld Supply Chain Foresight (2016), which suggest that South African supply chains need higher levels of information sharing.

Recent studies still show that 3PLs lack complete visibility in the supply chains within which they are operating. Langley (2019) reported that 49% of 3PLs who participated in the study had visibility into their customer's needs. This implies that the remainder of 3PLs who lacked insight into their customer needs may not be able to fulfil demand due to insufficient information (Ali *et al.*, 2017). The McKinsey Global Institute (2020) indicated the challenge of larger supply chain networks (such as the aerospace, communication equipment and food industries) to identify supply chain risks when information is not shared. Without complete visibility, these industries may not realise how heavily reliant they are on sub-tier suppliers, that will expose them to supply risks during demand spikes (McKinsey Global Institute, 2020). Naude (2020) studied the impact of the COVID-19 on South Africa's essential goods supply chains and found that South African fast moving consumer goods supply chains were operating on low margins, utilising extended trading terms to run their operations. Weber's (2021) study about the disruption of South African retail supply chains caused by the pandemic confirms that retailers struggled to streamline their supply chains to facilitate the high demand that stemmed from increased online shopping. These studies suggest that supply chains require information sharing with all their channel members, in order to fulfil demand (Naude, 2020), identify the cause and effect of supply disruptions, and to develop adequate response strategies (Weber, 2021).

Van Der Walt *et al.* (2021) argued that channel members who are reluctant to share information with 3PLs prevent supply chain network from realising the benefits derived from sharing information. This study aims to investigate the shortcomings of not sharing information by evaluating the enhancement of sharing information with 3PLs in order to improve information flow, enhance visibility and increase supply chains' performance improvement.

3. Problem statement
South African supply chain members remain reluctant to share information with their supply chain partners due to unequal distribution of risks, costs and benefits (Mathu, 2019). Studies by Bothma *et al.* (2014), KPMG (2013), Naude (2020), PWC (2016) and Weber (2021) suggest that

South African 3PLs lack complete visibility into the supply chain networks in which they are involved. Global studies by the Langley (2019) and the McKinsey Global Institute (2020) support that nearly half of supply chain companies around the globe were familiar only with their immediate tier partners while they knew very little about their entire supply chain network. Such supply chains commonly operate by focussing primarily on their own business while considering their extended supply chain networks in a limited way (Wiedmer and Griffis, 2021). Factors such as information quality, reliability and accuracy have been said to impede information flow in supply chains (Panahifar *et al.*, 2018). Relationship issues with channel members such as trust, a lack of collaboration and incompatibility limit the level with which information is shared amongst channel partners (Colicchia *et al.*, 2019; Hassan and Nasereddin, 2018; Van Der Walt *et al.*, 2021). Supply chain complexities stemming from organisational, technological, financial and cultural issues (Giri and Sarker, 2017) have been reported as some of the barriers which prevent efficient information flow within supply chains. This suggests a gap in information sharing with 3PLs for achieving efficiency and performance improvement for the entire supply chain. Given the value creating role of 3PLs in South African supply chains, it is necessary to study the enhancement of information sharing with 3PLs.

The focus of this study is on clients of a supply chain solutions company who have been provided with transport and warehousing software to enable them to offer 3PL services to various supply chain networks. These clients have been provided with information sharing solutions by the company in order to obtain and share information with channel members who they are servicing.

This study aims to evaluate the enhancement of information sharing practices with 3PLs at the solutions company for facilitating efficient supply chains. In order to achieve the main objective, these questions are formulated:

(1) What is the role of information sharing with 3PLs at the supply chain solutions company?

(2) Which channels are utilised to share information with 3PLs?

(3) Which supply chain performance changes have been realised upon the adoption of information sharing solutions?

4. Methodology

This study used a mixed methods design in order to evaluate the enhancement of information sharing with 3PLs. Information sharing with 3PLs involves multiple channel members, therefore research must be conducted from all perspectives, requiring multiple data strands to represent alternative views. According to Creswell (2021), the rationale of mixed methods research is that a combination of qualitative and quantitative components provides a better understanding of a research problem or issue than either research approach alone.

The methodological framework for the study was influenced by a pragmatic philosophy, which maintains that the world can be viewed from multiple realities (Saunders *et al.*, 2020). van Griensven *et al.* (2014) proposed that conducting mixed methods research provides researchers with the best of both worlds: the quantitative component provides a rich statistical element, while the qualitative strand provides meaning, context and depth. A mixed methods methodology is suited to this study since the various perceptions gathered from combined research methods will be used to conduct a thorough investigation of information sharing with 3PLs at the solutions company.

There is limited research in the area of information sharing with 3PLs and how it influences supply chain performance. Therefore, this study requires an in-depth look at the phenomenon under review. A case study approach was chosen to provide a richer understanding of

information sharing practice from multiple clients served by the solutions company and to capture the skills and competencies shared by company executives. Approaches by Stake (1995) and Yin (2014) have been cited extensively in case study research. The researchers hold the same opinion that it is essential to draw data from multiple sources in order to capture the case under study in its entirety. Stake (1995) advocates for case study research as it allows researchers to explore differences between cases and to replicate findings across them. Yin (2014) stated that a case study requires significant information in order to reach detailed and comprehensive conclusions. According to Lucas *et al*. (2018), case study research provides researchers with the flexibility to study complex experiences which may not have a specific or singular outcome.

Data were collected from a combination of qualitative and quantitative sources. Three data sources were collected to strengthen the accuracy of the findings and enrich the analysis which will be required to answer the research questions and enhance the practice of information sharing in SCM. The quantitative strand was gathered through an online questionnaire which was intended for company clients who were provided with information sharing software to share information with their 3PLs. The qualitative strand was represented by a focus group interview with executives at the solutions company as well as an open-ended questionnaire from both populations as a third data source. Ethical considerations were fulfilled by obtaining ethical clearance, informed consent, voluntary participation and ensuring anonymity. Table 1 shows the data collection tools that were used preceded by the sequence of data collection. These data collection tools were chosen to comply with mixed method principles for collecting case study data.

4.1 Data collection sources

4.1.1 Online questionnaire. The questionnaire was designed with twenty-one close-ended questions linked to the objectives of the study. The data collection tool was linked to the questionnaire tool and comprised of three sections. Section A related to the respondents' biographical information such as gender, age, qualifications, work and number of years. This information allowed the researcher to compare groups of respondents. Section B related to the respondent's perceptions about information sharing at their organisation. This information was used to establish whether their organisations were sharing information with 3PLs, the types of information shared, as well as their level of importance. Likert-type scales were used to obtain scores for each variable, anchored from 1 "not at all important" to 4 "very important". Section C related to the respondent's perceptions about their company's supply chain performance after they had adopted information sharing solutions to allow them to share information with their 3PLs. The SCOR model was used to measure the client's supply chain processes, including planning, sourcing, manufacturing and delivery. This model was most suited to the study because it covers a wide range of supply chain processes to measure the performances of both the supply chain and the various 3PLs. The validity of the questionnaire was measured to ensure that the questions were designed to answer the overall research objectives. In addition, the questions were discussed with the solution company's executives before data collection, so as to validate the accuracy and relevance of the questions.

Primary data sources	
Online questionnaire	The solution company's clients who have been provided with information sharing solutions that are directed at improving their operational effectiveness
Focus group interview	The solution company's executives who are involved in the provision of SCM solutions and the maintenance of client relationships
Open-ended questionnaire	A sample of clients who responded to the questionnaire and executives who participated in the focus group answered an open-ended questionnaire to provide clarity on close-ended responses and eliminate any bias in the focus group interview

Table 1.
Summary of data sources

4.1.2 Focus group interview. A focus group interview was conducted with the solution company's executives. The solution company is regarded as the facilitator that provides information sharing solutions to connect supply chain organisations and their 3PLs. Therefore, they serve as a proxy that provides perspectives on their clients and the 3PLs. The interview questions were designed from quantitative findings obtained from the questionnaire analysis. Open-ended questions were asked to give participants an opportunity to share their experiences and perceptions about information sharing for their clients and 3PLs. The questions' themes related to information sharing by clients and their 3PLS, types of information shared, the role of information sharing, the channels used by clients to share information, and the performance measurement of the clients and their 3PLs. An open-ended questionnaire, which collected additional data from the executives, was prepared to eliminate potential bias that could emanate from the shortcoming of group dynamics (Creswell, 2021).

4.1.3 Open-ended questionnaire. Two sets of open-ended questionnaires were designed with similar questions to suit the client and executive population. One was designed for clients who responded to the online questionnaire in order to clarify the meaning of their answers and interpret their motivation. The benefit of the data from open-ended questionnaire is that respondents may provide in-depth information that was not afforded in the quantitative process. The other set was designed for executives who participated in the focus group interview in order to obtain high level input from individual executives. The open-ended questionnaire comprised of five questions which were linked to the study objectives. Data such as the clients' and executives' understanding of information sharing, the types of information that are shared, the role of information, the channels used to share information and their supply chain's performance, were sought. These data were used as an additional data source to overcome information gaps and provide richer detail.

4.2 Sequence of data collection and analysis

Yin (2014) proposed that an explanatory case study must ideally be used when seeking to explore causal links that are complex. This entails a multiphase research process in which quantitative data are collected initially, followed by an additional round of qualitative data collection. The goal of implementing an explanatory sequence in this study was to discover findings from the qualitative study, which might have been omitted from the quantitative data collection phase, thus helping to explain the quantitative results (Creswell, 2021). Equal priority was given to the qualitative and quantitative strands. Data collection and analysis was conducted in three stages since three data sources were used to collect data. The three stages involved in the collection and analysis of data are illustrated in Figure 1.

4.2.1 Stage 1. An online questionnaire was distributed to the company's clients in order to overcome time, money and geographical constraints. The population included all companies that were provided with information sharing solutions by the solutions company. A sampling
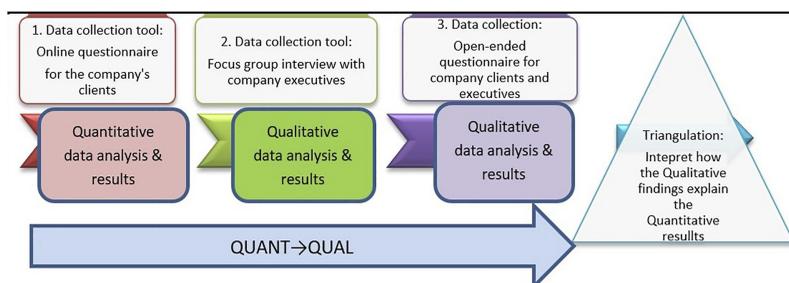
Figure 1.
The sequence of data
collection and analysis

frame of seventeen companies was used to randomly sample employees from the population. Probability sampling was selected as the preferred strategy. Bias of the respondents was eliminated by applying the simple random technique to allow for the representation of the entire population and generalisability (Salkind, 2018). This strand represented quantitative data. The IBM statistical package SPSS version 25 was used to analyse descriptive data. The statistical methods used to analyse and present the data included the univariate technique, to examine demographic data distribution; cross-tabulation, to compare variables between factors; multiple response analysis, to assess marginal similarity between various factors and charts, to present the data and to compare proportions between variables. Since this stage only represented the solution company's clients from a quantitative point of view, the next stage would represent the qualitative strand from the executives of the solutions company.

4.2.2 Stage 2. After the collection and analysis of quantitative data from the clients, a focus group interview followed with company executives. The purpose of the interview was to present the findings obtained from the solution company's clients so that the executives could confirm the responses and gain a deeper understanding of the quantitative findings. Three out of six executives (the chief executive officer and two directors) were purposively sampled to participate in the interview. Palinkas *et al.* (2015) indicated that qualitative studies seldom require a big sample from the studied population when the participants of the case provide sufficient data on the research topic. Most of the population was used and deemed acceptable given the participants' position in the company, their knowledge of information sharing and their years of experience in the industry. The participants' approval was sought, and the focus group interview data were recorded with a device and manually transcribed. A third stage of data collection through an open-ended questionnaire followed to gather detailed information from clients in order explain their quantitative findings to obtain individual feedback, thereby minimising group dynamics bias.

4.2.3 Stage 3. The third round of data collection entailed the distribution of an open-ended questionnaire to the clients and company executives in order to explain and validate the findings from the previous rounds of data collection. Two sets of open-ended questionnaires were sampled as follows: three companies were chosen randomly from the seventeen companies who responded to the questionnaire. E-mails containing the open-ended questionnaire were individually sent to the client managers as feedback of the questionnaire they participated in. The open-ended questionnaires were also individually emailed to the three executives who participated in the focus group interview.

The qualitative data obtained from the focus group interview and open-ended questionnaire were analysed separately since the format of the two data sources was different. The focus group involved face-to-face interaction, whereas feedback was obtained from individual participants through self-administered questionnaires. The qualitative data were coded and transcribed into a word document. The Atlas.ti tool was used to analyse the qualitative data. Content analysis was chosen as a suitable technique for analysing the transcribed data. Salkind (2018) defined this technique as the preparation of text data by systematically identifying codes and themes in order to interpret the content of the text.

5. Findings

Figure 1 illustrates that quantitative and qualitative data were analysed separately and the results were integrated during interpretation in order to validate the results. Measures to ensure credibility and trustworthiness were addressed by triangulating the data from the questionnaire, interview and the open-ended questionnaire. The purpose of corroboration was to identify similarities and differences between the quantitative and qualitative data strands. This is often conducted in order to combine the strengths of both data strands to compare results or to validate, confirm, or triangulate quantitative results with qualitative

findings (Harrison, 2013). The difficulty to generalise results from case study research and ensure the transferability has been established (Creswell, 2021; Yin, 2014). However, the findings from both data strands indicated that the results are likely to be transferable to other companies.

5.1 Quantitative findings

This section describes the practices of information sharing from the solution company's clients from a quantitative point of view. The analysis of the biographic information revealed that 69% of the respondents comprised of middle level managers, managers and senior managers. Most of the respondents had worked at their companies for a period of 1–5 years and 5–10 years respectively. The sample represented the appropriate population, as the profile of the respondents matches the clients sought for the study. The client's perceptions about information sharing were divided into the state of information sharing in their organisation, the types of information shared, the tools used to share the information, the barriers which prevented the companies from sharing information and the consequences of not sharing information. It was established that some levels of information sharing between clients and their 3PLs had occurred. It was found that clients traditionally relied on emails to share information. The information mostly shared with 3PLs was identified as customer-related information, such as inventory, delivery and customer service, as required for the fulfilment of customer demand. Problems such as high inventory levels, information distortion, poor visibility, long lead times and poor decision-making were commonly experienced while using traditional channels of information sharing. This compelled clients to adopt the WMS and TMS to share inventory and transport management information with 3PLs. The main barrier to sharing information was recorded as a lack of commitment within supply chain partners. As a result of this reluctance to share information, supply chains suffered the consequences of long lead times, which equated to distortion of information, increased supply chain costs, poor efficiency in the supply chain and sub-standard supply chain performance.

The performance of the client's supply chain was measured through the McNemar's test before and after the implementation of the services received from the solutions company. Pallant (2010) suggested that the test could be used to identify differences between two related groups. Respondents were asked to indicate their company's performance in relation to the planning, sourcing, manufacturing and delivery processes of their supply chains. They were asked to describe their supply chain performance before and after the implementation of information sharing solutions received from the company. Tables 2–5 displays the test results of the McNemar tests conducted for plan, source, make and deliver processes.

All the McNemar's tests conducted to assess the performance of plan, source, make and deliver processes showed an improvement after implementing the company's solutions. The data showed statistical significance since all the variables of the planning, sourcing, manufacturing and delivering processes yielded $p < 0.05$. Even though some processes showed relatively higher improvements than others, it can be concluded that the respondents indicated an overall improved performance in their supply chains after the implementation of services received from the solutions company. This indicates that sharing information improved the overall performance of the supply chain network, as suggested by Huang et al. (2017).

5.1.1 Qualitative findings from the focus group interview. The transcribed document from the focus group interview was imported into Atlas.ti software where 278 codes were created. The codes were then grouped into five themes that emerged from the five research questions, including information sharing, types of information, the role of information, channels for information sharing and supply chain performance measurement. The data from the focus group interview were used to interpret the quantitative findings.

		Plan			
				After implementation	
			Poor or fair	Good or excellent	Total
Before implementation	Poor or Fair	Count	2	11	13
		% before Dovetail solutions	15.4%	84.6%	100.0%
		% after Dovetail solutions	100.0%	64.7%	68.4%
	Good or Excellent	Count	0	6	6
		% before Dovetail solutions	0.0%	100.0%	100.0%
		% after Dovetail solutions	0.0%	35.3%	31.6%
Total		Count	2	17	19
		% before Dovetail solutions	10.5%	89.5%	100.0%
		% after Dovetail solutions	100.0%	100.0%	100.0%

		Chi-square tests			
	Value	Exact sig. (2-Sided)	Exact sig. (1-Sided)	Point probability	Mid-p-value
McNemar Test		0.001^a	0.000^a	0.000^a	0.001^a
N valid cases	19				

Note(s): The p values presented used an a alpha value 0.05 for all statistical tests

Table 2.
McNemar test results for plan processes

		Source			
				After implementation	
			Poor or fair	Good or excellent	Total
Before implementation	Poor or Fair	Count	2	11	13
		% before Dovetail solutions	15.4%	84.6%	100.0%
		% after Dovetail solutions	100.0%	64.7%	68.4%
	Good or Excellent	Count	0	6	6
		% before Dovetail solutions	0.0%	100.0%	100.0%
		% after Dovetail solutions	0.0%	35.3%	31.6%
Total		Count	2	17	19
		% before Dovetail solutions	10.5%	89.5%	100.0%
		% after Dovetail solutions	100.0%	100.0%	100.0%

		Chi-square tests			
	Value	Exact sig. (2-Sided)	Exact sig. (1-Sided)	Point probability	Mid-p-value
McNemar Test		0.001^a	0.000^a	0.000^a	0.001^a
N Valid Cases	19				

Note(s): The p values presented used an a alpha value 0.05 for all statistical tests

Table 3.
McNemar test results for source processes

Make			After implementation		
			Poor or fair	Good or excellent	Total
Before implementation	Poor or Fair	Count	1	11	12
		% before Dovetail solutions	8.3%	91.7%	100.0%
		% after Dovetail solutions	50.0%	64.7%	63.2%
	Good or Excellent	Count	1	6	7
		% before Dovetail solutions	14.3%	85.7%	100.0%
		% after Dovetail solutions	50.0%	35.3%	36.8%
Total		Count	2	17	19
		% before Dovetail solutions	10.5%	89.5%	100.0%
		% after Dovetail solutions	100.0%	100.0%	100.0%

		Chi-square tests			
	Value	Exact sig. (2-Sided)	Exact sig. (1-Sided)	Point probability	Mid-p-value
McNemar Test		0.006[a]	0.003[a]	0.003[a]	0.003[a]
N Valid Cases	19				

Note(s): The p values presented used an a alpha value 0.05 for all statistical tests

Table 4.
McNemar test results
for make processes

Deliver			After implementation		
			Poor or fair	Good or excellent	Total
Before implementation	Poor or Fair	Count	1	10	11
		% before Dovetail solutions	9.1%	90.9%	100.0%
		% after Dovetail solutions	100.0%	58.8%	61.1%
	Good or Excellent	Count	0	7	7
		% before Dovetail solutions	0.0%	100.0%	100.0%
		% after Dovetail solutions	0.0%	41.2%	38.9%
Total		Count	1	17	18
		% before Dovetail solutions	5.6%	94.4%	100.0%
		% after Dovetail solutions	100.0%	100.0%	100.0%

		Chi-square tests			
	Value	Exact sig. (2-Sided)	Exact sig. (1-Sided)	Point probability	Mid-p-value
McNemar Test		0.002[a]	0.001[a]	0.001[a]	0.001[a]
N Valid Cases	18				

Note(s): The p values presented used an a alpha value 0.05 for all statistical tests

Table 5.
McNemar test results
for deliver processes

(1) *Information sharing:* The information sharing theme confirmed that there were some levels of information sharing at the solutions company as indicated by the clients during the quantitative analysis.

(2) *Types of information:* The data confirmed that all types of information were shared between the clients and their 3PLs even though some types were observed to be at higher levels while other types of information were shared at lower levels. The participants were asked to rate the information types that were shared the most. Tracking information was rated as the number one type of information that was shared the most. However, data from the clients revealed that less than 50% of respondents were sharing order status and tracking information with 3PLs, while delivery schedules were the number one type of information that was shared to inform 3PLs about delivery timelines.

(3) *The role of information:* The analysis of the executive's data endorsed that there was an essential role of sharing information at the solutions company, as reported from quantitative findings. However, it was found that clients shared information that was relevant to them and that there was no uniformity. The executives were asked about their perception of the visibility of information within their client's supply chain. The participants felt that information visibility was critical and that limited levels of information sharing could be ascribed to the competitive nature of the supply chain industry.

(4) *Channels of sharing information*: The executives indicated that their clients used traditional communication methods, such as verbal communication, meetings, emails, telephone and fax to share information. However, their clients have since resorted to technological solutions to share information. Even though traditional information methods were still relevant, automated technological systems were found to be the best channels for sharing information. Synchronisation and technological fit were emphasised as important factors to allow a seamless information flow.

(5) *The measurement of supply chain performance:* The executive's perception on performance measurement validated the results from the McNemar's test. The test suggested that information sharing had improved overall performance of clients and their 3PLs at the solutions company. The executives validated that their client's performance had improved since the adoption of information sharing solutions, as established from the quantitative analysis. The performance metrics indicated by the executives were found to be similar to the core attributes of SCOR, namely reliability, responsiveness, agility, costs and asset management (APICS, 2018). Even though some of these metrics could differ from client to client, they could be applicable to most organisations, since the SCOR framework has a wider coverage of supply chain performance metrics.

5.1.2 Qualitative findings from the open-ended questionnaire. The open-ended questionnaire provided an opportunity for the research questions to be answered with credibility by comparing the data from clients and executives who were asked to provide their opinion on the same set of questions. The analysis generated 167 quotations and 139 codes which were clustered into five themes that emerged from the research questions. The data revealed a lot of similarities between the opinions of the clients and executives at the solutions company.

(1) *Information sharing:* The findings revealed that the participants had a general understanding of information sharing from the clients and executives. While the

clients indicated the critical importance of information for facilitating a seamless flow of goods in their supply chain and for achieving an optimum level of customer service (by balancing supply and demand), the executives stated that sharing information was essential for communication and meeting supply chain goals.

(2) *Types of information:* The data showed that there were some differences in opinion on the most shared types of information. The clients generally felt that inventory information was the most shared type of information. On the other hand, some executives felt that tracking, services and deliveries were the most important types of information. Some differences between the two populations emerged: the executives advocated for more frequency in information sharing for some types of information, while the clients were reluctant to share more information because of a lack of collaboration and poor technological systems.

(3) *The role of information*: Some differences emerged in the perception of the role of information sharing at the solutions company. The clients perceived that information improved the overall level of customer service, while the executives perceived that information assisted in the collaboration of channel members and the attainment of overall objectives of the supply chain network.

(4) *Channels of sharing information:* Both populations emphasised that automated channels of sharing information should be used to facilitate the sharing of information between supply chain organisations and their clients. Consensus on the use of emails as a channel for sharing information emerged from both populations. This implies that, despite the latest developments for sharing information, emails were still considered as a reliable channel for sharing information. This finding was also confirmed by quantitative findings, which revealed that emails were the most used traditional method of sharing information with 3PLs.

(5) *The measurement of supply chain performance*: There was general consensus from clients and executives data on the improved performance of clients' supply chain as a result of better information sharing. However, it was indicated that some supply chain processes, such as planning and sourcing needed greater improvement. Therefore, higher levels of information sharing with 3PLs were required to improve planning processes. The client and executive's data suggest that delivery processes at the solutions company was excellent. These data are consistent with the findings from the first data set which revealed that deliver processes at the solutions company had improved after the implementation of information sharing solutions.

6. Discussion and conclusion
The study findings confirm that information sharing has a positive impact on the effective management of the supply chain. This section amalgamates the findings from the collected three data sources. The triangulated data revealed that technology plays a vital role in the facilitation of information sharing. The executives revealed that technology allowed information to be shared with speed and limited effort. However, clients indicated that the synchronisation of technological systems and technological upgrades were required to allow a seamless flow of information. The bullwhip effect, high inventory levels, poor visibility, long lead times and poor decision-making emerged from the client's questionnaire as consequences that were suffered by supply chains as a result of not sharing information. Collaboration was emphasised by clients and executives as the greatest benefit of information sharing. The findings in this study have

business implications for supply chain channel members, for the enhancement of information sharing. The analysis of the findings can inform decision-makers and clients about effective measures to enhance information sharing in their supply chains.

(1) The role of technology is crucial in managing the flow of information in the supply chain. The triangulation of the results showed that the practice of information sharing can improve the supply chain's overall performance. These findings postulate that supply chains rely on IT solutions and businesses to effectively execute their organisations' operations and meet the strategic goals of their supply network. Supply chains are expected to invest in technological infrastructure that allows individual networks to execute their roles with complete visibility. These empirical results are compatible with other studies conducted on information sharing and technology in SCM. Technology has improved communication in the supply chain by eliminating time and location barriers allowing supply chains to share information without time and geographical constraints (Giri and Sarker, 2017). Gunasekaran *et al.* (2017) emphasised that technology has reduced costs by automating manual methods of sharing information. These cost reductions have created a completely new and interconnected supply chain environment.

(2) Long lead times were identified as recurring problems. The persistent threat by long lead times to supply chains implies that organisations should consider improving the real-time applications of technology for sharing information, in order to reduce lead times that are associated with supply chain processes. Long lead times threaten the efficiency of the supply chain (Ponte *et al.*, 2018). Lengthy lead times increase the safety or buffer stock that is held in excess of cycle inventory due to demand and lead time uncertainties (Chopra, 2019) therefore, lead times must be reduced in order to minimise safety inventories. Ponte *et al.* (2018) argued that increased and prolonged lead times result in decreased customer satisfaction and, as such, more safety stock is required to achieve a desired level of customer service levels. As a result, more inventory carrying costs are incurred. This suggests that channel members should seek techniques for reducing lead time.

(3) Insufficient information visibility is suffered by channel members who lack synchronised technological infrastructure to facilitate the flow of information. The Barloworld Supply Chain Foresight (2016) also found that the lack of visibility or data is a concern for South African businesses. These data imply that there are problems with effectively managing relationships with 3PLs in order to achieve the supply chain network goals. The executives emphasised that it was essential for their clients to have real-time visibility of information with their 3PLs in order to meet the supply network goals. The biggest challenge for achieving visibility was found to be the competitive nature of the industry. The executives proposed that technology and collaboration were imperative in enhancing the practice of sharing information in the solutions company.

(4) Collaboration with suppliers was emphasised by clients and executives as the greatest benefit of information sharing. There was consensus that the practice created benefits such as collaboration of the supply chain, better coordination, increased competitive advantage and better customer service. Dominguez *et al.* (2017) advocated that inefficiencies of the supply chain can be overcome by sharing information through collaborated supply chain partners. Collaboration encourages all supply chain partners to participate in joint forecasting, planning, information and resource sharing (Raweewan and Ferrell, 2018). Channel members should continue to collaborate with other members within and outside their supply networks in order to intensify the benefits of information sharing.

7. Value of the study

The value of the study contributes to an existing body of knowledge about the significance of 3PLs and information sharing in supply chains that can be used to improve information sharing with 3PLs. The study highlights the need for channel members to develop collaborative relationships with 3PLs, who provide valuable services for meeting the needs of the entire supply chain. The findings could be used to cultivate supply chain management, its operations and relationships amongst channel members. The study furthermore contributes to the critical debate on how organisations rely on technology in supply chains and how a need exists for organisations to continuously update technological infrastructure in order to meet supply chain network goals.

8. Limitations

The major limitation of this study was the restricted generalisability inherent to a case-study methodology, a small sample size and a slower response rate. Although the study findings are limited to a single solutions company, this limitation was offset by the multiple data strands, which provided insights from various perspectives in the supply chain. The insights suggest that the results may be universal to supply chains in South Africa and is supported by findings from Mashiloane et al. (2018) which found a significant positive relationship between information sharing and supply chain performance.

9. Recommendations for future research

Future researchers can extend the study to a wider client base in other sectors of the supply chain for cross-checking. It would be beneficial to increase the sample size to improve statistical power and generalisability of the results. Techniques such as the analytic hierarchy process (AHP) and the multi-attribute utility theory (MAUT), as used in related research studies, could be used to highlight priority areas that need to be addressed, thereby setting a framework base for improvement of organisational information sharing processes. A longitudinal study could also be conducted to track the progress of information sharing, to establish the changes and improvements that might occur over time, and to identify other supply chain trends and best practices.

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