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INFLUENCE OF INFORMATION TECHNOLOGY ON LOGISTICS INTEGRATION AND DELIVERY RELIABILITY OF SMALL AND MEDIUM ENTERPRISES IN GAUTENG PROVINCE

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─Abstract ─
Products and services have no value unless they are in the possession of the customers when (time) and where (place) they wish to consume them. Delivery reliability is so important that non-adherence could lead to SMEs failure. On the other hand, the ability of SMEs to meet delivery orders on time could lead to business success, which may further depend on the extent of information technology and logistics integration. The spread of information technology is transforming both global and local flow of goods, services, finance and information. As a result, creating value for customers has led to many organisations, if not all, looking for a more agile strategic road map that could help in understanding how to satisfy customers better and improve both business and service performance. Information technology makes it possible for different SMEs in the supply chain network to integrate their systems and databases despite compatibility differences. Information technology improves the flow of information and information exchange, as well as response time at various levels of the supply chain network. Effective business design and execution depends on how technology is used to deliver services faster, cheaper and with better quality than that of competitors. The purpose of this study is to determine the influence of information technology on logistics integration and SMEs delivery reliability in Gauteng province. Through a quantitative method using Smart PLS, this study tested the relationships among the three variables, which are information technology, logistics integration and delivery reliability. The results showed that there is a positive relationship between research variables. The proposed study is expected to have practical and theoretical implications to SMEs owners and managers. In addition, it will provide added insights and knowledge to the existing body of literature.

Key words: *information technology, logistic integration, delivery reliability, supply chain, SMEs, Gauteng province*
JEL Classification: L1

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1. INTRODUCTION

Products and services have no value unless they are in the possession of the customers when (time) and where (place) they wish to consume them (De Keizer, Akkerman, Grunow, Bloemhof & van der Vorst 2017; Yu, Cadeaux & Song 2017). The need for value logistics triggers product and service delivery reliability within the supply chain network. According to Pinto, Mettler and Taisch, (2013), delivery reliability is an important success factor for competitive performance; a non-adherence could lead to SMEs failure (Jane 2011). The primary objective of any established organisation, whether small, medium or large, is to enhance value-added benefits of product and service offered to customers. However, ensuring delivery reliability is one strategic means of enhancing value-added logistics within a supply chain network (Jitpaiboon 2014; Al-Shboul 2017). Kumar and Kumar (2004:311) define delivery reliability as,

"ensuring that the right product (meeting the requirement of quality, reliability and maintainability) is delivered in the right quantity, at the right time, in the right place, from the right source (a vendor who is reliable and will meet commitments in a timely fashion), with the right service (both before and after sale), and, finally, at the right price".

As the emerging competitive environment is becoming more customer oriented, so are organisations strategically reconfiguring their business strategy to include faster response means to outperform competitive rivals (He, Xie, Wu, Hu & Dai 2016; Al-Shboul 2017). Therefore, SMEs ability to meet delivery orders on time could lead to business success. In the recent competitive environment, information technology is one of the most embraced strategies by organisations to enhance competitive advantages (Pinto *et al* 2013; Soderholm & Norrbin 2014). Similarly, with globalisation and digital transformation reconfiguring the traditional supply chain process, SMEs delivery reliability may depend on well-integrated logistics activities and the implementation of information technology (Wilkin, Couchman, Sohal & Zutshi 2016; Fuchs & Otto 2015). In other words, a successful SMEs logistics integration to delivery reliability performance could mean success in information technology connectivity. According to De Mattos & Laurindo (2017:86), "Increased organizational effectiveness is obtained by applying information technology in a more comprehensive and integrated manner to support aspects of organizational processes". This may lead to a higher level of reliable customer service, customer satisfaction, lower inventory as well as lowest total

logistics costs that are necessary in terms of time and place value (Bakar & Jaafar 2016). SMEs are a major contributor to the GDP; therefore, this study questions to what extent the adoption of information technology, by SMEs in Gauteng province, influence their logistics integration to aid effective and efficient product/service delivery reliability. Hence, the need for this study is important.

2. THEORETICAL REVIEW, HYPOTHESIS AND RESEARCH FRAMEWORK

2.1. Information technology

The importance and benefits of information technology are well known among practitioners, researchers, academicians as well as government institution (Zheng, Zhao & Stylianou 2013; Mitic, Nikolic, Jankov, Vukonjanski & Terek 2017). Some of these benefits, according to Love, Matthews, Simpson, Hill and Olatunji (2014) and Ali, Whiddett, Tretiakov and Hunter (2012), include reduction in SMEs operating costs, improved quality of new product development, integration of information exchange among SMEs and supply chain partners, integrated information flow between project teams, reduction in the propensity for reverse logistics and improvement in interoperations efficiency as well as the whole life cycle associated with customer relationship management. Creating value for customers has led to many organisations, if not all, to look for a strategic road map that helps them understand how to satisfy customers better and improve both business and service performance (Azma, Mostafapour & Rezaei 2012; Dong & Netten 2017). Information technology brings about a fundamental connectivity that rectifies the way individuals, organisations and environments relate to each other, combining it with a new way to bring value to the society through various information communications (Henfridsson & Lind 2014). Through information technology, SMEs are able to analyse their market position within the competitive environment. They are also able to analyse the necessary skills and expertise required to ensure optimum use as well their impact on economic development (Dong & Netten 2017).

Information technology makes it possible for different SMEs in the supply chain to integrate their systems and databases despite compatibility differences (Singh & Teng 2016). Information technology improves the flow of information and information exchange, as well as response time at different levels of the supply chain network (Zheng *et al.* 2013; Kossai & Piget 2014). Effective business design and execution depends on how technology is used to deliver services faster, cheaper

and with better quality than competitors do (De Barros, Ishikiriyama, Peres & Gomes 2015; Gunasekaran, Subramanian & Papadopoulos 2017).

Recently, many organisations have been unable to operate efficiently without the use of information technology as it enables SMEs to connect, be informed and engage through communication with suppliers and customers around the world (Kossai & Piget 2014; Acar & Uzunlar 2014; Kim & Chai 2017). With all the daily business challenges, SMEs rely on information technology for sustainability, to make their business process relationships less challenging and to achieve business goals and objectives (Esteves, Santos & Anunciacao 2012). Information technology drives supply chain networks due to advancement of product through Internet marketing and sales, product and service quality assurance, support for all organisation's technical activities like infrastructure, core activities, edge and production services and accounting and finance (Trainor, Rapp, Beitelspacher & Schillewaert 2011; Lee, Kim & Kim 2014; Peppard, Galliers & Thorogood 2014; Royle & Laing 2014). The ability to determine the need of customers faster and deliver significant services to customers at any time that they need it requires information technology to be successful in achieving organisational goals (Marinagi, Trivellas & Sakas 2014). In the emerging economic and competitive environment, organisations need to be more productive and competitive to grow. One way forward lies in new information technology, which can help firms become more competitive, both locally and on a global scale. Information technology is important for SMEs as it not only reduces costs, but also enhances delivery reliability and organisational growth. It also helps SMEs plan, execute and manage strategy, risk, operations, finance, people and customers Ye & Wang 2013; Zhou, Shou, Zhai, Li & Wu 2014; Kobelsky, Larosiliere & Plummer 2014). Therefore, it is hypothesised:

H_1: Information technology has a positive significant influence on logistics integration

H_2: Information technology has a positive significant influence on delivery reliability

2.2. Logistics integration

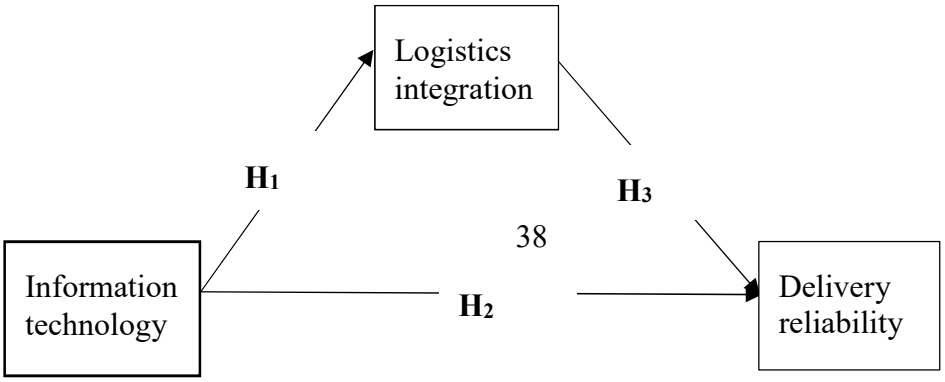
The inter-organisational logistic activities within SMEs should be closely coordinated in such a way that both the inbound and outbound distribution of goods with suppliers and customers are well integrated and are characterised by excellent distribution, transportation and warehousing facilities. Logistics, according to

Pienaar and Vogt (2016:13), "is the inbound movement of materials and supplies, and the outward movement of finished products. Its goal is the delivery of finished products required by the marketing department to the point where they are needed, when they are needed, in the most economical fashion". Therefore, SMEs product and service delivery reliability highly depend on effective logistics integration. Logistics integration coordinates the flow of materials, information and finance in order to improve business performance and customer satisfaction (Farhanghi, Abbaspour & Ghassemi 2013). SMEs within a supply chain network integrate shared information across organisational boarders for effective planning, execution and controlling the logistical activities (Colin, Galindo & Hernandez 2015). According to Prajogo and Olhager (2012), integrated logistic functions aid administrative and operational processes and lead to more aided SME decision-making and enhanced delivery reliability. In addition, favorable cost and efficient services such as higher levels of follow-up with customers for feedback, organic linkage with customers through information technology and agility of ordering process that can benefit customers as well as economies of scale may result (Danese, Romano & Formentini 2013; Lee *et al* 2014; Palma-Mendoza, Neailey & Roy 2014). Furthermore, SMEs may be a step ahead of their competitors as they are able to supply value-added products and meet customers' specific requirements in the right condition, at the right time and place. Therefore, it is hypothesised that:

H_3: Logistics integration has a positive significant influence on SMEs delivery reliability

Drawing from the literature on logistics integration, information technology and SMEs delivery reliability, a conceptual framework is developed as shown in Figure 1. The model consists of three constructs, that is, one predictor variable – information technology, one mediating variable – logistics integration and one outcome variable – SMEs delivery reliability. The model argues that logistics integration by SMEs positively influences their delivery reliability. However, this influence is predicted by information technology.

Figure 1: The conceptual framework



3. RESEARCH METHODOLOGY

This study adopted a quantitative approach to establish the relationship between the research variables. The approach is appropriate because it enabled the researchers to empirically test and confirm the proposed hypotheses relationships and to explain the impact of information technology and logistics integration on SMEs delivery reliability.

3.1. Instrument and data collection

The data used for this study was collected among SMEs operating within the southern Gauteng region, South Africa. To ensure the relevance of the data in evaluating the influence of information technology on logistics integration and SMEs delivery reliability, SME managers, owner-managers and officials were allowed to participate in the completion of the questionnaire. A structured questionnaire comprising the three research constructs with research scales adopted from previous studies was used with necessary modifications made in order to fit the current research context and purpose. The questionnaire began with the demographic information section, which also incorporated the business characteristics such as annual sales, physical assets, number of employees and the type of industry to which the business belongs. The data were needed to establish a detailed profile for the sample. Informational technology and logistics integration items were adapted from Chen & Paulraj (2004), while the delivery reliability scale was adapted from Al-Shboul (2017). The measurement items for all three constructs were measured on seven-point Likert scales to express the degree of agreement, with one being strongly disagree, to seven being strongly agree. A total of 251 usable questionnaires were retrieved for the final run of data analysis. A letter of consent was signed by the SME owners or managers along with their company stamps to acknowledge they have read, received and also understood that the information gathered from the questionnaire was for the research purpose only.

4. DATA ANALYSIS AND RESULTS

4.1. Demographics characteristics of the SMEs

In terms of the SMEs annual sales, a total of n=86 (34.3%) rated their annual sales as less than R1 million, which was followed by n=84 (33.4%) whose annual sales were R1 million but less than R5 million. The physical assets for the majority of the SMEs were less than R4 million (n=123, 49.0%). This was followed by n=60 (23.9%) who indicated that their physical assets were worth R4 million but less than

R8 million. The majority of the SMEs had less than 50 employees (n=157, 65.5%), while only n=58 (23.1%) employed 50 to 99 employees. Most of the SMEs business operation (n=99, 39.4%) falls within the wholesale and retail business sector, for example repair of motor vehicles, motor cycles, personal and household goods, hotels and restaurants. While the second highest number of SME business operations (n=42, 16.7%) falls within community, social and personal services. SME participants who were managers amounted to n=156 (62.2%) and n=95 (37.8%) were owners.

Table 1: Measurement accuracy assessment and descriptive statistics

Research constructs	Indicators	Descriptive statistics		Reliability statistics			Validity statistics		
		Mean ($\bar{x}$)	SD	Alpha (α)	*Rho*	CR	AVE	√AVE	Factor loading
Information technology	IT1	5.15	1.447	0.909	0.912	0.930	0.690	0.831	0.724
	IT2	5.04	1.406						0.866
	IT3	5.11	1.449						0.888
	IT4	5.08	1.437						0.877
	IT5	4.98	1.453						0.823
	IT6	4.70	1.686						0.794
Logistics integration	LI1	5.08	1.303	0.886	0.890	0.913	0.637	0.798	0.777
	LI2	5.12	1.179						0.771
	LI3	5.15	1.268						0.827
	LI4	5.53	1.266						0.785
	LI5	5.33	1.345						0.803
	LI6	5.22	1.338						0.822
Delivery reliability	DR1	6.06	1.052	0.839	0.854	0.892	0.675	0.822	0.805
	DR2	6.13	1.034						0.873
	DR3	6.09	1.088						0.865
	DR4	6.17	1.068						0.737

Note: Alpha (α) = Cronbach's alpha; Rho= Dillon-Goldstein's *rho; CR=Composite reliability; AVE=Average variance extracted*

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4.2. Psychometric Properties of the measurement scale

To analyse statistically the measurement and structural models for this study, the SMART-Partial least squares (SMART-PLS 3) for structural equation modelling procedure was deemed appropriate because of its ability to handle complex predictive models in both small and large sample sizes (Chinomona & Pooe 2013). Smart PLS is a component-based method of analysis that has the ability to model latent constructs that are uncontaminated by measurement error under conditions of non-normality (Ringle, Wende & Will 2005). Psychometric properties of the measurement scale are reported in Table 1, which presents the research constructs, Cronbach alpha test, composite reliability (CR), average variance extracted (AVE) and item loadings.

Three statistical methods, namely Cronbach's alpha test (α), Rho value and composite reliability test (CR) were used to assess the internal reliability of the measurement model. From Table 1, the alpha values for all three constructs range from 0.839 to 0.909, Dillon-Goldstein's rho values range from 0.854 to 0.912, while the composite reliability values range from 0.892 to 0.930 respectively. These values are all above the threshold of 0.7, indicating good internal consistency, reliability, information technology, logistics integration and delivery reliability (Johnson & Christensen 2012).

The AVE value for this study range from 0.637 to 0.690. These values are greater than the estimated value of 0.5, which further indicates an acceptable level of internal reliability and validity of the research construct (Khosrow-Pour 2006:75; Vinzi, Chin, Henseler & Wang 2010:437). Convergent validity was determined using the obtained factor or outer loadings, which were expected to be above 0.5. Drawing from Table 1, all item loadings are greater than 0.5 (i.e. ranging from 0.724 to 0.888). This indicates acceptable individual item convergence in the validity of all scale items. Discriminant validity was done by assessing whether inter-correlation matrix among the constructs are less than the square root of the AVE and that the HTMT values are below 0.90 (Garson 2016:43). In Table 2, the inter-correlation values for all paired latent variables are less than $\sqrt{}$AVE (ranging from 0.798-0.831) and HTMT values (ranging from 0.304-0.471) respectively indicate the existence of discriminant validity (Khosrow-Pour 2006).

Table 2: Correlation analysis results and discriminant validity measures

Constructs	Information technology	Logistics integration	Delivery reliability
Information technology	0.831		
Logistics integration	0.362	0.798	
Delivery reliability	0.273	0,414	0.822
Heterotrait-Monotrait ratio (HTMT): (IT – LI =0.396), (IT – DR =0.304), (LI – DR =0.471)			

Figure 2: Path model results and factor loadings

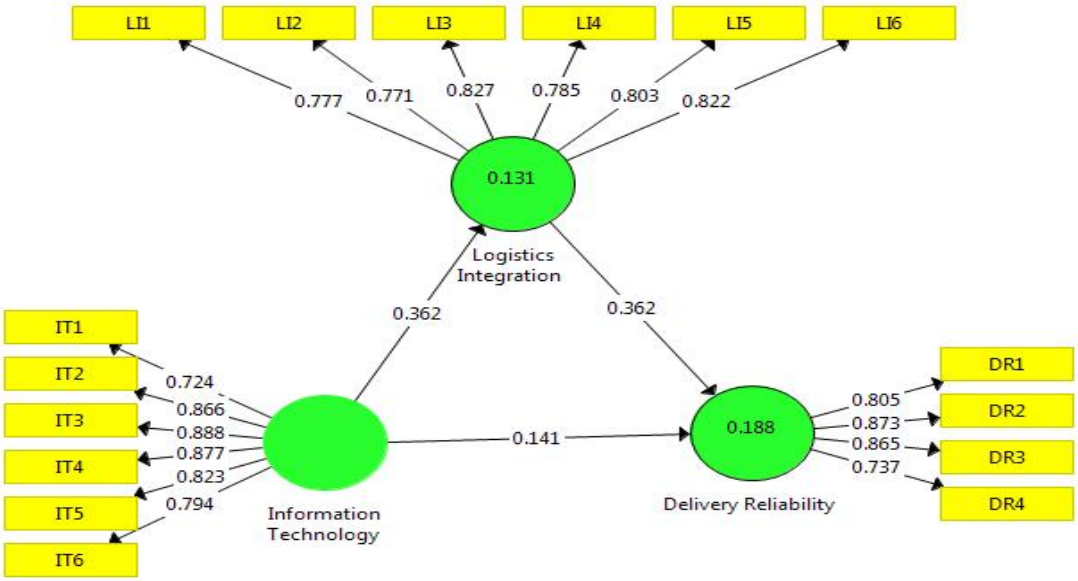

Table 3: Results of structural equation model analysis

Proposed path relationship	Hypothesis	Path coefficient	T-value	Outcome
IT ⟶ LI	H_1	0.362	5.527	Supported
IT ⟶ DR	H_2	0.141	4.895	Supported
LI ⟶ DR	H_3	0.362	2.034	Supported

Table 3 presents the three hypothesised relationships, path coefficients, t-statistics and the decision criteria. To determine whether the path coefficients are significant, a bootstrapping procedure was carried out, which provided the t-values for each path estimate. A significant relationship is expected to have a t-statistics that is above two (Chin 1998). Drawing from the results provided in Table 3, all hypothesised relationships between the research constructs (H_1, H_2 and H_3) were statistically significant.

4. DISCUSSION AND CONCLUSION

The purpose of this study was to determine the influence of information technology on logistics integration and SMEs delivery reliability. Three hypotheses were proposed and data were collected from SMEs in the southern Gauteng region. The empirical results for the three hypothesised relationships were statistically significant and supported. From the study findings, it is noted that information technology has a stronger effect on logistics integration (path estimate=0.362; $p=0.00<0.05$) than its direct effects on SMEs delivery reliability (path estimate=0.141; $p=0.00<0.05$). This indicates that although information technology may have a significant effect on delivery reliability, a higher level of delivery reliability performance would most likely result if the logistical activities are well integrated. According to Zheng *et al.* (2013) and Kossai & Piget (2014), information technology enables SMEs to integrate information flow between project teams with possible reduction in the propensity for reverse logistics and improvement in inter-operation's efficiency as well as the whole life cycle associated with customer relationship management. Hypothesis 3 further confirms the above statement (path estimate=0.362; $p=0.00<0.05$), indicating that a well-integrated logistics activities can result in higher levels of SMEs ability to ensure enhanced, dependable delivery to customers (Farhanghi, Abbaspour & Ghassemi 2013). Therefore, SMEs products and services delivery reliability highly depend on

effective logistics integration through effective alignment of information technology.

5. IMPLICATIONS OF THE STUDY

The importance and implications of delivery reliability among SMEs in southern Gauteng, South Africa cannot be overlooked. This is because, as the global competition expands with customers' demanding more fast and convenient delivery, SMEs ability to enhance on-time delivery reliability within the supply chain has become even more relevant than before. Therefore, this study has a significant implication to both SMEs owners or managers and academics. On the academic side, this study makes a significant contribution to the SMEs logistics integration and delivery reliability in South Africa. This study provides a statically significant finding that supports the proposition that information technology has a significant effect on SMEs logistics integration activities and delivery reliability. Therefore, information technology is a significant antecedent and a competitive strategy to aid delivery reliability. On the practitioners' side, the importance of the influence of information technology on logistics integration and delivery reliability among SMEs in southern Gauteng is highlighted. This study implies that practically, SMEs logistics integration activities and delivery reliability can be enhanced through the use of information technology. Furthermore, given the strong relationship between information technology, logistics integration and delivery reliability, SMEs need to invest and implement information technology into its network integration planning and operations to improve delivery reliability as well as overall firm performance. With this, coordinated information exchange between the SME and its supply chain partners may become faster, thereby accurately fulfilling customer requirements in terms of both quality and delivery time.

6. LIMITATIONS AND FUTURE RESEARCH

The overall significant contributions of this study are not without limitations. This study only focuses on two main factors of SMEs delivery reliability performance, which are information technology and logistics integration. Future studies may investigate other factors such as flexibility, customers' service commitment and operational requirements, geographical location and supply network structure to determine a more robust SMEs delivery reliability performance. This will also contribute significant new knowledge to the existing body of information technology and supply chain. Furthermore, the study is limited to SMEs in the southern Gauteng region, South Africa and as such, the study data were generated

from this region. To be more informative on issues such as SMEs delivery reliability, subsequent research should be carried out in other provinces in South Africa, which may be further extended to other developing countries in Africa.

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