LOGISTICS TECHNOLOGY COMPATIBILITY ISSUES AND INTEGRATION CHALLENGES AMONG SMES IN VANDERBIJLPARK

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-Abstract-

The announcement of COVID-19 progressing from epidemic to pandemic has threatened organisations' continued business existence and operations. Like every other organisation and business sector, SMEs must strategise, more than ever before, responsive measure to business disruptions and challenges amid the COVID-19 pandemic. In response to external environmental pressure on SME business operations, this article seeks to assess logistics' technological compatibility challenges as well as integration challenges among SMEs in Vanderbijlpark. However, apart from policy and business constraints related problems that are external influencing factors, Most SMEs business challenges are still internally based due to the lack of logistics technology compatibility and integration to aid operations performance. To this end, in the COVID-19 pandemic era, recommendations presented in this research are SME-based solutions. Importantly, SMEs that convincingly and strategically market their products/services through efficient and effective utilisation of logistics information and communication technology can survive and improve sales volume through offering a quick response time to the customer(s). Furthermore, the researcher concludes that information technology compatibility can enhance knowledge management, streamline order management, increase visibility and reduce SMEs order cycle time. The data collected from the 131 SME participants were quantitatively analysed using SMART-PLS version 3.

Key words: SMEs, Logistics, Information technology, Internal logistics challenges, External logistics challenges

JEL Classification: L1, M15

1. INTRODUCTION

South African SMEs are categorised into survivalist, micro, very small, small and medium enterprises (Fatoki 2016). Like every other economy in the world, the SME sector contribution to national development, job creation, export promotion and many more, as noted in the Bureau for Economic Research (BER 2016), cannot be over-emphasised. South Africa's SME area of domination cuts across mining and quarrying, manufacturing, electricity and gas, construction, retail and motor trade and repair services, wholesale trade and commercial agents (Republic of South Africa, 2003; BER 2016). SMEs within South Africa account for about 91 percent of the country's total business (Abor & Quartey 2010). They are responsible for 52 to 57 percent of the national gross domestic product (GDP) while contributing 61 percent to employment in the country (Abor & Quartey 2010). SMEs control nine out of every ten enterprises and provide two out of every three jobs (European Union commission 2015), therefore, require adequate attention. With the increasing external and market pressure on the existence of SMEs, the need for resilience innovation and strategy is essential for SMEs survival.

Like every other organisation and business sector, SMEs must strategise, more than ever before, responsive measures to business disruptions and challenges amid the COVID-19 pandemic (Ivanov 2020). With this, the South African government should create a boomerang strategy and support initiatives to stimulate the SME sector during COVID-19. In line with the significant impact of SMEs within and outside the South African economy, thrusting logistics information compatibility and integration into the mix of governmental initiatives and support strategies will further strengthen the SME sector. For SMEs to survive, the need for logistics information technology is essential because logistics information technology enables SMEs business performance by responding quickly and integrating product, finance and information flows across suppliers and customers. Many scholars such as Tripathy, Aich, Chakraborty and Lee (2016), Nasiri, Ukko, Saunila and Rantala (2020) and Eggers (2020), have reviewed the literature on SMEs supply chain performance and information technology. However, little has been said about logistics technology compatibility issues and integration challenges among SMEs, specifically in Vanderbijlpark. This research strategically models SMEs technology implementation challenges within and outside the organisation.

2. LOGISTICS INFORMATION TECHNOLOGY

Surrounded by a fast and turbulent competitive environment, organisations' continued survival depends on the re-examination of both internal and external business forces that may impact positively or negatively on business performance. These business forces may include, but are not limited to, globalisation, organisation consolidation, empowered consumers, government policy and regulations, technology as well as the need to combat COVID-19 pandemic disruptions (Coyle, Langley Jr, Novack & Gibson 2017). This has necessitated the need for SMEs to implement new business strategies to improve flexibility and responsiveness that ensures business sustainability (van de Wetering, Mikalef & Helms 2017; Omoruyi 2018). Technology is the biggest agent of change (Coyle *et al.* 2017; Chege & Wang 2020) and it is defined as the enabler of internal and external logistics processes that enhance product and service flows, information flows, demand and financial flows in supply chain. Internally, information technology can enhance positively logistics efficiency and effectiveness of SMEs. For example, warehouse operations, demand management, order fulfilment and transportation carrier collaboration for quick response and elimination of uncertainties and bullwhip effects (Nasiri, Ukko, Saunila & Rentala 2020).

Externally, information technology creates a new form of competition or a new business model (Chang, Chen & Lu 2019; Imran, Hamid, Aziz & Hameed 2019). For example, the Internet being connected 24/7 and providing the opportunity for SMEs to compete on equal terms with larger organisations, social networks (Facebook or Twitter), the world's 'knowledge pool' connection, which enables the compression of time and distance, as well as the transfer of timely information. Several logistics information technologies for compatibility and integration have been identified. Examples of logistics technology are warehouse management systems (WMS), enterprise resource planning (ERP), electronic data interchange, materials requirement planning (MRP) and decision support systems (DSS) (Coyle et al. 2017; Nurmadewi & Mahendrawathi 2019).

H1: The implementation of logistics information technology has a positive influence on SMEs internal business and logistics challenges

H2: The implementation of logistics information technology has a positive influence on SMEs external business and logistics challenges

3. SMES BUSINESS/LOGISTICS CHALLENGES

According to the Council of Supply Chain Management Professionals (CSCMP), "logistics management is that part of supply chain management that plans, implements, and controls the efficient, effective forward and reverse flow and storage of goods, services, and related information between the point of origin and the point of consumption in order to meet customers' requirements."

The logistics definition shows that skills and capabilities are essential for efficient product flows, information flows and financial flows. The quest for better enhancement of logistics efficiency in terms of place and time utility has revolutionised logistics information technology for visibility, flexibility, responsiveness and collaboration (Giusti, Manerba, Bruno & Tadei 2019). However, notwithstanding the numerous contributions of SMEs to the South African economy, SMEs efficiency and effectiveness has often been limited by inadequate or lack of skills, finances, supply chain and marketing difficulties, weakness in research and development (R&D) operationalisation (Sikhwari 2015; Song, Yang & Yu 2020). The lack of business managerial competency poses a significant challenge to integrating the right information technology for effective collaboration and competitive advantages (Bouwman, Nikou & Reuver 2019).

Logistics, as the implementation of supply chain strategy and as the backbone for organisation's growth, can negatively affect SMEs growth without the necessary logistics infrastructure put in place (Mageto, Prinsloo & Luke 2018). SMEs ability and capability to deliver the right product in the right quantity and condition to the right customer in the right place and time depends on the extent of logistics technology compatibility across the logistics chain and logistics integration (Kherbach & Mocan 2016). These challenges may hinder SMEs from implementing the most effective business strategy that enhances value-adding and customer satisfaction. SMEs, faced with the business challenge in building strategic connections and collaboration, may further hinder knowledge management, learning and logistics technological compatibility. Hence, the research proposed that:

H3: SMEs internal business/logistics challenges can increase the level of external logistics challenges faced by SMEs.

4. RESEARCH METHODOLOGY AND MEASURING INSTRUMENT

Based on the proposed model for this research, a quantitative method of data collection and analysis was used to determine the reliability and validity statistics. Through nonprobability random sampling, the questionnaire was conveniently

distributed among 131 SME owners and managers. The research used a nonprobability convenient sampling technique because it was impossible to include all SMEs in Vanderbijlpark (Etikan, Musa & Alkassim 2016). However, the participating SMEs have a known chance of being selected for the research less stringently and cost-effectively (Gravetter & Forzano 2012:118).

The instruments that measure logistics challenges were adopted from Mafini and Omoruyi (2013) and were factorised to categorically determine internal and external logistics challenges among SMEs. Items for logistics information technology are bar-coding, warehouse management systems (WMS), performance measures, distribution resources planning (DRP), automated storage/retrieval system (AS/RS), vehicle routing/scheduling, fibre optics communications technology and satellite communication technology (Murphy Jr & Knemeyer 2018).

5. DATA ANALYSIS AND RESULT

Nearly one-third of the SMEs have been in operation for 2 to 4 years and about one quarter have been in operation for 5 to 7 years and 11 or more years. The majority of the SMEs have annual sales of <R1 million (n=68; 51.9%), followed by those SMEs with yearly sales of R1 million to ≤ R5 million (n=32; 24.4%). In terms of the participating SMEs physical assets, most of the SMEs had an asset base of <R4 million (n=84; 64.1%), which was followed by those who had physical assets of R4 million to ≤ R8 million (n=32; 24.4%). A total of (n=109; 83.2%) have fewer 50 employees, about (n=13; 9.9%) have 50 to 99 employees, and only about (n=9; 6.9%) of the SMEs had a workforce of 200 and more. Lastly, the majority of the participating SMEs were in the trading sector (n=35; 26.7%) and (n=29; 22.1%), (n=22; 16.8%) as well as (n=10; 7.6%) were in the services, food and beverage and wood and furniture respectively.

5.1 Reliability and validity of the measurement scales

Due to the limited sample size, the SMART PLS version 3.0 for structural equation modelling was performed to model the relationship's significance levels, statistical power and the suitability of the research variables (Wong 2013). Table 1 shows the descriptive statistics, reliability and validity results.

Table 2: Reliability and validity of the measurement scales

Research constructs	Indicators	Descriptive statistics		Reliability statistics			Validity statistics	
		Mean ($\bar{x}$)	SD	Alpha (α)	CR	AVE	√AVE	Factor loading
Logistics information technology	TEC1	4.740	1.536	0.925	0.939	0.658	0.811	0.677
	TEC2	4.542	1.479					0.783
	TEC3	4.809	1.377					0.819
	TEC4	4.542	1.426					0.848
	TEC5	4.519	1.474					0.855
	TEC6	4.473	1.469					0.798
	TEC7	4.313	1.658					0.891
	TEC8	4.374	1.617					0.799
SMEs Internal logistics challenges	ICH1	4.505	1.485	0.856	0.902	0.698	0.836	0.793
	ICH2	4.527	1.458					0.841
	ICH3	4.595	1.324					0.884
	ICH4	4.542	1.458					0.822
SMEs External logistics challenges	ECH1	4.092	1.449	0.924	0.938	0.656	0.810	0.748
	ECH2	4.260	1.536					0.825
	ECH3	4.282	1.463					0.869
	ECH4	4.298	1.502					0.862
	ECH5	4.725	1.404					0.735
	ECH6	4.351	1.493					0.793
	ECH7	4.198	1.510					0.846
	ECH8	4.366	1.484					0.788

Note: Alpha (α)=Cronbach's alpha; *CR=Composite reliability; AVE=Average variance extracted,* √AVE; Squared root of average variance extracted

According to Johnson and Christensen (2012), alpha (α) value and composite reliability (CR) value should be greater than 0.7 to be acceptable. From Table 1, the alpha (α) and the CR values range from 0.856 to 0.925 and 0.902 to 0.939, respectively. The validity result was determined using the average variance extracted (AVE) value and the factor loading estimates, which should be greater than 0.5 for acceptability (Khosrow-pour 2006:75; Vinzi, Chin, Henseler). The estimated worth of the AVE and factor loadings for this research ranges from 0.656 to 0.698 and 0.677 to 0.891, respectively, which indicates the research measurement variables are excellent and consistent. Going further with the internal consistency of the research variable, Garson (2016), states that the square root of average variance √AVE for each latent variable should be higher than the correlations

among the latent variables to determine the existence of discriminant validity. Tables 1 and 2 show the presence of discriminant validity because the √AVE values are more significant than the inter-correlation values.

Table 2: Correlation analysis results and discriminant validity measures

Constructs	External logistics challenges	Internal logistics challenges	Logistics information technology
External logistics challenges	**0.810**		
Internal logistics challenges	0.698	**0.836**	
Logistics information technology	0.471	0.38	**0.811**

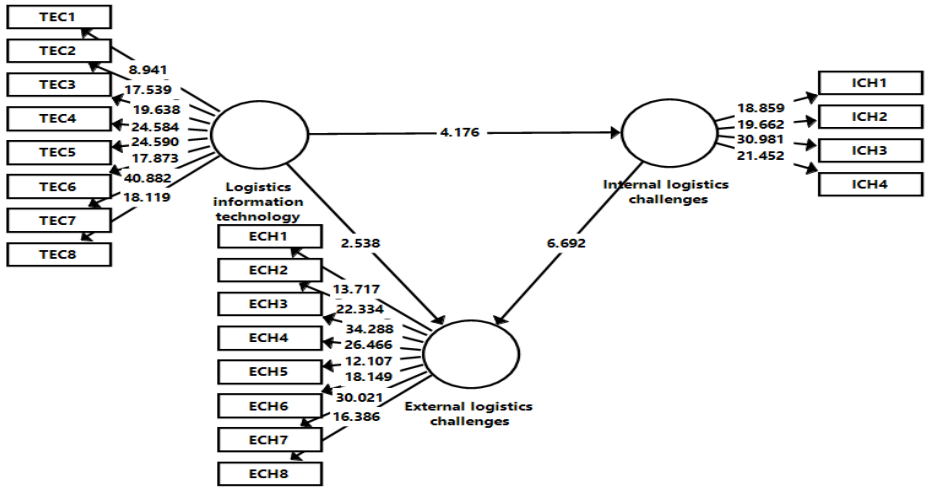

Figure-1: Bootstrapping significance

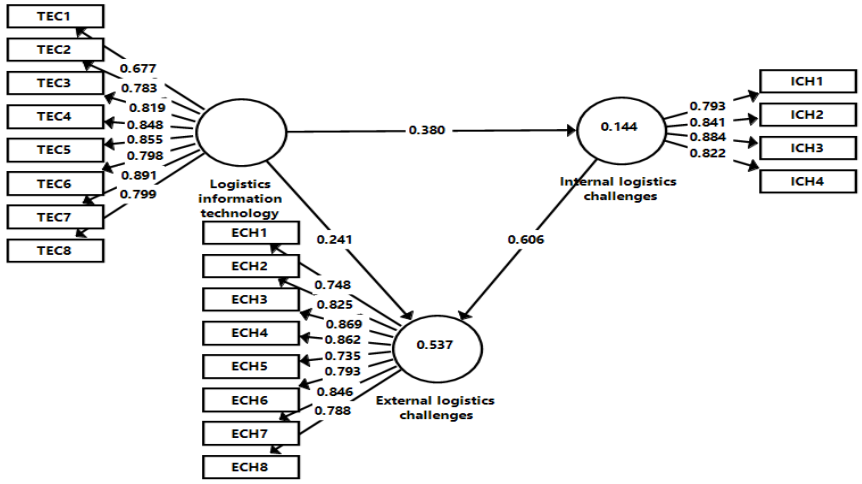

Figure-2: Path Model Estimates

Table 3: Path coefficient results

Proposed path relationship	Hypothesis	Path coefficient	T-value	P-value	Outcome
TEC - ICH	H_1	0.380	4.176	0.000	Supported
TEC - ECH	H_2	0.241	2.538	0.000	Supported
ICH - ECH	H_3	0.606	6.692	0.000	Supported

According to Gason (2016) and Gravetter, and Wallnau (2017:669), the inner path coefficients for all latent variables should be greater than 0.5 (p-value ≤0.05), while the outer path coefficient for latent variables should be higher than 1.96 (t-statistics ≤0.96) to be considered statistically significant. Table 3 and Figure 2 observed that the t-statistics value and p-value are highly significant, indicating a strong relationship among the research variables.

6. DISCUSSION

The hypothesised relationship between logistics information technology and internal logistics/business challenges of the participated SMEs was statistically significant at the t-statistics value of 4.176. Furthermore, the path result of the structural equation model also shows a predictive relationship (path estimate

=0.380; p=0.00o<0.05) and explained about 47 percent (R2=0.144). This result revealed that the efficient and effective use of information technology, especially during this COVID-19 pandemic, could ease and provide solutions to SMEs internal business/logistical challenges. For example, logistics information technology such as bar-codes, performance measurement systems, WMS, DRP, EDI, vehicle routing/scheduling systems, fibre optics and satellite communication technology can enable SMEs to gain greater visibility and knowledge management. With this, SMEs can create a service solution to customers with responsiveness at the right time (Wong & Davison2018). As a result, there is greater awareness of customer demand via point-of-sale data, which could result in better coordination of manufacturing, marketing and distribution of products and services for customer satisfaction (Asadi 2011; Pham, Nguyen, McDonald & Tran-Kieu 2019). Streamlined order processing and reduced lead times are possibilities with information technology. This study is consistent with Gunasekaran, Subramanian & Papadopoulos (2017) that the adoption of logistics information technology can reduce SMEs complexity optimisation, collaboration effort, cross-channel visibility and incentive challenges, which may result in sustained competitive advantages.

In the case of the relationship between logistics information technology and SMEs external logistics challenges H2, the result indicates a significant level of 2.538 and a predictive relationship (path estimate=0.241; p=0.000<0.05). Logistics technology explained about 54 percent (R2=0.537) of SMEs external logistics challenges. This result indicates that logistics information technology explains or reduces more than half of SMEs external logistics challenges. Due to this, the participating SMEs rated performance measurement systems, DRP, AS/RS and fibre optics communication technology as essential logistics technology for communication, ordering purposes and use during operations.

Logistics performance measurement systems like management information system (MIS) and executive information system (EIS) help SMEs convert data into useful information for managing and monitoring organisational performance, thereby leading to SMEs logistics excellence (Barbosa & Musetti 2011). For this article, lack of quality logistics personnel, organisational transformation, refocusing of logistics activities on necessary skills and increased environmental concerns are the most reported external challenges among the participating SMEs, which information technology has greatly influenced. For example, quality control performance is possible through the application of information systems and procedures to enhance the flow of goods, services, finance and information in a timely, cost-effective and efficient manner. Organisational transformation is the integration of emerging technology and strategy into business and supply chain

processes to efficiently and effectively satisfy the needs of the new digital consumers (Zhu, Ng, Wang & Zhao 2017). In addition, increase environmental concerns has also been made possible through logistics information technology. Therefore, the implementation of logistics information technology can reduce SMEs external logistics challenges.

Following the importance and benefits of information technology on internal and external logistics challenges, issues such as financial constraints, lack of skills/competencies within SMEs workforce, in conjunction with the high cost of information technology as well as rapid technological advancement can lead to the increase of external logistics challenges faced by SMEs. This hypothesised relationship was accepted and supported at a t-statistics value of 6.692. The path result of the structural equation model shows the highest predictive relationship (path estimate=0.606; $p=0.000<0.05$) and the highest explanatory power of about 54 percent ($R2=0.537$), as in the case of logistics information technology and external logistics challenges. The research findings revealed that information technology and internal logistics problems are like a two-edged sword that can either increase or ease SMEs business challenges. SMEs, therefore, need to be more innovative in dealing with business challenges. The findings support the research carried out by Nurmadewi and Mahendrawathi (2019), stating that the decrease in SMEs business performance is associated with SMEs inability to implement new logistics technology, as well as research and development capability that can enhance market innovations.

7. CONCLUSION AND MANAGERIAL IMPLICATIONS

The research determines the level of SMEs logistics technology compatibility issues as well as technology integration challenges among the SMEs in Vanderbijlpark. The three proposed research hypotheses underwent statistical testing using the SMART PLS version 3.0. The research findings revealed a healthy level of statistical significance among the research variables. The results emphasised the importance of logistics information technology toward mitigating SMEs business challenges and further explained that internal logistics challenges could increase SMEs inability to compete successfully. For example, practically, to improve business performance, SMEs should strive to implement new information technology. However, SMEs first need to consider internal logistics integration to ensure effective external logistics performance. As such, the relationship's significance between logistics information technology and internal logistics challenges were found more effective and appropriate than the relationships between logistics information technology and external logistics challenges. SMEs

should learn from the conceptual research model's results to strengthen logistics technology integration to enhance customer and supplier relationships.

Government intervention in this regard is also essential. The government intervention approach may begin by establishing strategic workshops aimed at developing networking SMEs within the sub-region of southern Gauteng. Through this means, effective business management and vital knowledge sharing may aid SMEs in internal and external business challenges and the implementation of logistics information technology for higher business performance. Awarding competition programs for SMEs logistics technology implementation and capability to compete effectively among rivals can play a strategic role in boosting SMEs logistics information technology integration and promote SMEs collaborative relationships with larger organisations. This intervention may enhance SMEs capability to sized external challenges within the market environment such as changes in consumer behaviour, technology advancement, economic regulation and global trade as collaborating opportunities to be more flexible and responsive to survive within the intensely global competitive environment (Maduku, Mpinganjira & Duh 2016; Chi, Huang & George 2020). The research findings show that due to the SMEs technology integration incapability, collaborative relationship within the supply chain in terms of logistics compatibility requirements within the supply chain seems almost impossible.

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