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Factors influencing Information and Communication Technology Diffusion in Nigeria's transport logistics industry: an exploratory study

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Abstract
Modern transport and logistics management is replete with the applications of advancements of Information and Communication Technology (ICT). However, the barriers to ICT innovation diffusion in the industry are widely acknowledged, particularly in the context of developing countries. Although ICT innovation diffusion reflects a continuum of conditional forces that coalesce around institutional forces; how different locally-evolved factors are influencing ICT diffusion in the developing logistics markets remains an under-researched issue. Moreover, ICT innovation acceptability and operative constraints of various stakeholders in the industry also remains a subject of concern. This paper combines primary qualitative studies (focus group discussion and in-depth expert interviews) to explore (i) how institutional forces in Nigeria are influencing ICT diffusion in the transport and logistics industry, using evidence from the local 3PL SMEs, (ii) the perceptions of the relevant stakeholders concerning ICT diffusion challenges in the industry and their roles in modulating them. The systematic analyses of the qualitative data, including content, thematic, magnitude coding, and interpretative procedures provide a useful way of understanding the mechanisms influencing ICT diffusion in Nigeria's transport and logistics industry and where discourses differ. In exploring the views of the stakeholders, one can observe that institutional forces are more oriented towards complexity than predictability, doing little to address either the structural challenges of the industry or the operational threats of the local logistics operators. The study concludes by illustrating that a turn towards institutional voids thinking will help advance sustainable ways to mitigate ICT diffusion challenges in the Nigerian transport and logistics industry.

Keywords: ICT; diffusion; 3PL SMEs; Nigeria; transport and logistics industry; innovation

1 Introduction

For years, researchers have studied the many challenges relating to ICT implementation challenges within the transport and logistics industry, though mainly in the context of the developed countries rather than in developing countries (Tob-Ogu et al., 2018). The complexity of the locally-evolved issues affecting the rate of ICT diffusion in the transport and logistics industry in developing countries as Nigeria, together with the potential conflicts of the relevant stakeholders, calls for all-inclusive solutions. Indeed, factors influencing efficient ICT diffusion in the transport and logistics context are inherently complex due to the various interests of the relevant collaborators, intricate logistics systems and the diversity of the institutional challenges (Banomyong et al., 2008, Banomyong, 2017, Mondragon et al., 2017). Precisely, some of the identified factors influencing effective ICT adoption among logistics collaborators include cost relating to licensing fees for software and consultancy services, ICT training, and lack of trust (Loonam, 2008, Kumar et al., 2018); government legislation and size of organisations (Mondragon et al., 2017), as well as infrastructural deficits (Apulu et al., 2011, Tob-Ogu et al., 2018). Further, other scholars have also recognized the importance of addressing the various views of relevant stakeholders in the quest for realising sustainable ICT diffusion in the transport and logistics industry, with the premise that the concerned stakeholders often need support to make the required resources available (KOMODA, 2009, Stathopoulos et al., 2012, Kumar et al., 2018).

Therefore, this study utilizes primary qualitative data (gained through focus group discussion and in-depth expert interviews), carried out with relevant stakeholders to identify and explain how institutional forces are shaping ICT diffusion in the Nigerian transport/logistics industry. The study also assesses the stakeholders' perceptions of ICT diffusion challenges in the industry and their roles in mitigating them, using the following guiding research questions:

- Research question 1: How are institutional forces shaping ICT diffusion in Nigeria's transport and logistics industry?
- Research question 2: What are the stakeholders' perceptions of ICT diffusion challenges in the industry and their roles in modulating it?

The study participants include selected transport/logistics practitioners, public administrators/professionals in the related field, researchers, and transport/logistics union leaders. Results highlight how institutional problems fit into the structural challenges, and in turn, ICT related operational challenges among the logistics service providers in Nigeria. By studying these causal interrelationships, this study points to a range of context-specific concerns and offers insight into ways relevant stakeholders/actors might develop relevant policy actions and operational strategies to deal with the research problems. This paper is organized as follows. Section two covers the literature review and theoretical framework. In section three, the research methodology is described. Section four highlights the research findings, while section five covers the discussion and conclusion of the study.

2 Literature review

2.1 ICT innovation in the transport and logistics industry: prospects and challenges

ICT has advanced supply chain and logistics operations, primarily by increasing competitiveness (Grover and Kohli, 2012, Wang et al., 2011, Wamba et al., 2015), supply chain integration and performance (Prajogo and Olhager, 2012, Liu et al., 2016), cost reduction, visibility and tracking, exchange and real-time information (Radstaak and Ketelaar, 1998, Li and Olorunniwo, 2010), efficiency and responsiveness (Gunasekaran and Ngai, 2004, Subramani, 2004, Subramanian et al., 2014, Gunasekaran et al., 2015a, Gunasekaran et al., 2015b), and effective collaboration among the relevant stakeholders and actors (Ketchen and

Hult, 2007). Nonetheless, the uptake of recent ICT advancements has been low (Harris et al., 2015) which may be linked to the conflicting interests of the relevant stakeholders (KOMODA, 2009). According to Harris et al. (2015), factors influencing ICT adoption in the logistics and supply chain management can be categorized into seven: (a) user-related barriers, (b) economic and financial factors, (c) operation related barriers, (d) management capability, (e) technology related barriers, (f) collaborators influence, and (g) policy related barriers. Some of these issues are common in the Nigerian transport and logistics industry due to the persistent infrastructural deficits, lack of innovation skills, digitally divided region, and lack of government support for innovation (Apulu and Latham, 2011, Tob-Ogu et al., 2018).

Specifically, user-related barriers encompass economic and managerial challenges (Harris et al., 2015) which are more pronounced among small and medium logistics service providers (Harindranath et al., 2008, Kuan and Chau, 2001, Stefansson, 2002). This understanding is relevant in explaining the perceived reluctance of 3PL SMEs towards adopting relevant ICT tools (Pokharel, 2005, Tob-Ogu et al., 2018). Other barriers include financial constraints (Evangelista and Sweeney, 2006, Hollenstein, 2004, Zeimpekis and Giaglis, 2006, KOMODA, 2009) which are more evident in developing countries such as Nigeria due to lack of enabling environment related to poor political governance (Kayisire and Wei, 2016, Tob-Ogu et al., 2018, Apulu et al., 2011). The operational related barriers coincide with lack of human capital (Pokharel, 2005, Hollenstein, 2004, Zeimpekis and Giaglis, 2006), as well as reluctance to accept changes among traditional logistics operators (Perego et al., 2011, Huckridge et al., 2010). These align with Lyytinen et al. (2009) argument that several factors such as social backgrounds and technical orientations affect efficient utilization of ICT among prospective users. Accordingly, Kumar et al. (2018) recommend advanced planning for socio-technical issues that could disrupt the implementation of ICT innovations in logistics and supply chain industry as this could lead to huge financial loss.

Other ICT adoption barriers include technology and policy related barriers. Technology-related barriers are framed around poor interoperability of logistics systems, security, and data protection challenges (Harris et al., 2015). Policy-related barriers refer to the applications of ICT innovations which have to pass through regulation and represent the effects of institutional forces in shaping organizational activities (Meyer and Rowan, 1977). Many argue that relevant stakeholders/actors should modulate efficient interoperability of information across specific supply chains (Perego et al., 2011, Pokharel, 2005, Piplani et al., 2004). Hence, this study focuses on mapping how institutional forces influence ICT diffusion in the Nigerian transport/ logistics industry, and understanding stakeholders' perception of the identified issues, as well as their roles in modulating them.

Related studies in the field suggest that local transport companies in Italy adopt ICT at a low level, mainly for routine operational activities (Marchet et al., 2009). The authors adopt a qualitative case study approach. Smart (2010) investigates factors affecting e-procurement adoption, involving three industrial firms and discovers that organisations tend to lack knowledge of factors influencing their e-procurement. The study applies in-depth interviews with the managers of the organisations. A study of factors influencing e-business adoption amongst telecommunication and tourists firms using factor and logistics regression suggests that indecision about the extent of ICT adoption is the major inhibitor (Oliveira and Martins, 2010). An empirical survey of Australian transport and logistics companies (using factor and analysis and logistics regression) suggests cost of ICT adoption (e.g., running cost) and financial constraints as the main inhibiting factors (Nguyen, 2013). A multiple case study survey of factors influencing ICT adoption in multi-modal seaport terminal operations suggests that government legislation and organisational size are the main influencing factors (Mondragon et al., 2017). Similarly Tob-Ogu et al. (2018) utilize multiple case studies and in-depth interview to map ICT adoption in road freight transport in Nigeria, and findings show

that level of ICT adoption are mainly determined by local contextual factors (competitiveness, safety, and regulation) and firm size. Again, a literature review of block-chain adoption challenges in India and USA suggests differences in adoption behaviour between the two countries based on different professional approaches (Queiroza and Wambab, 2019).

2.2 Theoretical framework

An ideal logistics system is perceived as a state where its different components, including, the institutional framework, infrastructure, shippers/consignees and service providers are fully functional (Banomyong et al., 2008, Banomyong, 2017, Kayisire and Wei, 2016, Mondragon et al., 2017). In the context of the developing countries as Nigeria, institutional framework, infrastructure, and service providers often draw attention to vulnerability of the local logistics operators (Tob-Ogu et al., 2018). Vulnerability in this context refers to operational threats of the local logistics firms, mainly regarding factors militating against ICT diffusion in the industry. The priority areas are usually to raise awareness on where policy interventions, development funds, as well as operational strategies should be directed to monitor improvement in logistics performance (World Bank, 2018, World Bank, 2013), as demonstrated in the conceptual framework (Figure 1). The conceptual framework was developed to highlight the interactions between the identified components of the logistics system. Different locally-evolved interacting factors usually initiate ICT diffusion challenges in the context of developing countries, and the extent the local 3PL SMEs can utilize the relevant ICT resources are contingent upon the outcomes of the interactive effects of context-specific factors (Ezenwa et al., 2018, Tob-Ogu et al., 2018). Yet, there is a general view that assessments of ICT diffusion challenges amongst the local 3PL SMEs are often taken in isolation from the institutional perspective (Evangelista et al., 2013), particularly in the context of developing countries (Tob-Ogu et al., 2018).

Figure 1 Conceptual framework

Infrastructural challenges are now widely acknowledged as a critical factor militating against efficient logistics performance in developing countries as Nigeria (World Bank, 2018, World Bank, 2013). Indeed, the growing interest in understanding the forces behind the state of affairs concerning logistics infrastructure/performance has made the conceptual framework relevant in mapping the mechanism influencing ICT diffusion amongst the local 3PL SMEs in Nigeria. Our research utilises two primary qualitative studies to reflect how institutional forces shapes the activities of the local 3PL SMEs (Bell, 1973, Meyer and Rowan, 1977). These reflect the conceptual framework of the study, reflecting the interactions of the institutional voids, structural problems, and operational challenges of the local 3PL SMEs (Figure 1).

Scientific definitions and frameworks guiding ICT innovation and adoption are generally imprecise, for example Rogers' Diffusion of Innovation (DOI) theory (2003); the Technology Acceptance Model (TAM) (Davis, 1993); the Technology- Environment-Organization (T-O-E) framework (Tornatzky and Fleischer, 1990) and the Theory of Planned Behaviour (TPB) (Fishbein and Ajzen, 1975). These align with their deductive approaches which makes it difficult to understand how context-specific issues interact to influence the characteristics of the logistics system. Sometimes, these issues are captured separately, paying less attention to institutional and firm-level forces that combine to impact on management strategies, centred on resource accumulation and coordination for sustainable competitive advantage (Grant, 1991, Wernerfelt, 1984). However, due to the institutional framework surrounding logistics systems, institutionalism has tended to guide external influences assessment (Dimaggio and Powell, 1983). Therefore, institutional theory considers how formal structure of organizations in the post-industrial era (Bell, 1973) dramatically reflects the myths of their institutional environment instead of the demand of their work activities; how

rationalized institutional rules influence organizational structure (Meyer and Rowan, 1977). The argument stems from the fact that relationships between institutional rules and organizational efficiency often conflict sharply and tend to undermine organizational support for legitimacy. Despite criticism of institution theory relating to its lack of recognition of the firm's capacity to evolve strategies innovatively (Palsson and Kovacs, 2014), its relevance is widely supported by its potency to link firms' strategies and external pressure/external forces that impact on the firms' capabilities (Tate, 2014). In this paper, we conceptualize institutionalism as a theoretical phenomenon that relates to ICT adoption among freight operators in Africa, and Nigeria in particular (Tob-Ogu et al., 2018). Hence, we apply its indicators (see Figure 1) to explain the dynamics of ICT diffusion challenges in the Nigerian transport and logistics industry.

3. Methodology

3.1The study locations and demographic characteristics of participants

The study locations are Lagos and Imo States, Nigeria (Figure 2). Lagos was former capital Lagos of Federal Republic of Nigeria, located in the South-Western region of the country (latitudes 6º23'N and 6º 41' and longitude 70º 42'E). On the other hand, Imo State is located in South-Eastern, Nigeria (Latitudes of 5'10 and 5'67N; Longitude 6'36 and 7'28E). Eight panellists and five interviewees (Table 1) were purposely selected for the focus group discussion (FGD) and in-depth expert interview (IEI) based on their professionalism, experience, and presence in the exploratory scoping study in our earlier work.

Table 1 Demographic characteristic of respondents

The FGD panellists are coded p1, p2, and p3 …, while the in-depth expert interviewees are coded I1, I2, and I3 for confidentiality purposes. The demographic information of the FGD participants shows that the management staff of the respective organizations participated in the study, comprising Nigeria's Shippers Council (NSC), Chartered Institute of Logistics and Transport (CILT), relevant High Institutions, Logistics organizations, and the National Maritime Administration and Safety Agency (NIMASA). Their years of experience ranged from eight to twenty years, and all have a minimum of University degree. For the IEI participants, they are also senior personnel in their organizations, comprising National Port Authority (NPA), Flour Mill Company, Transport Union (associations), transition parks, and logistics firms. Similarly, their years of experience ranged from seven to twenty-six years, and all claimed to have a University degree.

Figure 2 Maps of Lagos and Imo States, Nigeria, indicating the study locations

3.2 Data collection and analysis

Field exercises were conducted sequentially starting with the FGD, which took place on mid-August, 2017 in Lagos city, which lasted about three and half hours. Similarly, the IEIs were conducted in November 2017 across four locations in Lagos city, and a fifth session in Owerri, Imo State, Nigeria, which lasted ninety minutes per session. Importantly, the discussion and the interviews reached a point of diminishing returns when all the discussants /interviewees exhausted their professional experiences or views (Lindlof, 1995). The selection process was purposive using the spokespersons of the relevant professional organisations (e.g., Nigeria's chapters Chartered Institute of Logistics (CILT) and Transport and Chartered Institute of Transport Administration (CIoTA). The data collection materials were disseminated through the spokespersons of the professional organizations, including a consent form, official

application, and information sheets. The discussion and interviews included questions categorised into themes, reflecting the research context, regarding institutional issues, stakeholders' roles in the industry, and operational characteristics of the local logistics operators.

The fieldwork drew insight from the previous phases of the research project, buttressing the mechanisms through which ICT diffusion takes place in Nigerian transport/logistics industry, using evidence from the activities of the local 3PLs SMEs. Here, we reflect the role of governmental institutions in the context of providers of enabling an environment for effective/efficient ICT diffusion in the industry, including the provision of infrastructure, regulations, and bureaucratic processes in order to tease out the mechanisms through which the local 3PL SMEs are impacted. Data collection were achieved with the help of four trained field assistants; conducted in English language (mixed with local dialects), particularly for the in-depth interviews that involved the local transport/logistics union leaders, transit park managers, and transport/logistics representatives. The veracity of the data was achieved through the involvement of multiple participants from the diverse backgrounds (see Table 1), as well as the systematic protocol observed during data collection, which combines to enhance the chain of evidence (Yin, 2014).

The FGD was supplemented with the IEIs. Reflection on the data collected was undertaken jointly with the key participants (and spokespersons of the professional organisations who have followed the research progress from inception) through continual dialogues/follow-up interviews. Data analyses were conducted using content, thematic, magnitude (Saldaña., 2016), and interpretative procedures (Elliott, 2000), with the view to respond to the research questions accordingly. Specifically, the content analysis (text query search, using Navigo 11) was applied to map specific codes used for thematic and magnitude analyses, which were conducted manually. The outcomes of the thematic and magnitude analyses of the FGD data were used to demonstrate the conceptual model (Figure 1), reflecting the interactions of the institutional voids and structural challenges that combine to trigger operational threats for the local 3PL SMEs. The outcomes of the IEIs help to reinforce FGD findings, as well as mapping the stances (+/-) of the local stakeholders in modulating ICT diffusion in the industry and the local 3PL SMEs.

4. Results

4.1 Unpacking how institutional forces are shaping ICT diffusion in Nigeria's transport and logistics industry

Three broad themes emerged from the FGD data analyses with the associated subthemes and codes, as well as their magnitudes (see Table 2). The results indicate as follows: First, out of the 114 codes generated from the FGD data, institutional voids constitute 29 (25.40%); structural, 44 (38.60%), and operational, 41 (36.0%) codes within the three broad themes. For the sub-themes, institutional voids comprise irregular intervention schemes/policies (12, 40.70%) and political corruption (17, 59.30%). The sub-themes are further sub-divided into four codes: low budget for innovation (4, 11.10) and fragmented approach (8, 29.60) for the irregular intervention/policies sub-theme. On the other hand, political corruption comprises misappropriate of public find (7, 25.90%) and nepotism (10, 29.60%), (see Table 2). The structural problems comprise infrastructural deficits (38, 86.30) and poor bureaucratic process (6, 13.70%) as subthemes. The corresponding individual codes involve unstable electricity supply (12, 27.30%), dilapidated road network (10, 23.20%), lack of data management system (9, 20.40%), and lack of adequate telecommunication platforms (7, 15.40%) for infrastructural

deficits, while poor bureaucratic processes encompasses only disorganized sector (6, 13.70%) as the lone code. The operation challenges as a theme involve reduced individual difference factors (30, 73.70%), limited scope of business (5, 12.20%), as well as lack of motivation (6, 14.10%). The individual difference factors are further divided into low education status (18, 45.10%) and ICT experience (12, 28.60%). The magnitude coding results correspond to 114 frequencies of 13 codes, 7 sub-themes, and three themes (see Table 2).

Table 2 Thematic and magnitude coding results from the FGD data

The results suggest that the FGD panellists deliberated more on the structural challenges and operational problems than on institutional voids. The outcome does not come as a surprise as both the structural and operational themes are the outcomes of the institutional voids, which inherently require more attention for critical accounting of the effects of the institutional-triggered challenges. Individual, political corruption (misappropriation of public funds and nepotism) represents the major issue treated within the institution void context, followed by irregular intervention/policy auctions (low budget for technology innovation and fragmented approach). The infrastructural deficits (unstable electricity, dilapidated road network, lack of data management system, and lack adequate telecommunication platforms) cover the portion of the structural challenges, followed by the poor bureaucratic process (disorganized sector). Last, the reduced individual characteristics factors (ICT experience and education of the local logistics operators) represent the main focus of the FGD panellists within the perspective of the operational problems, followed by the limited scope of business and lack of motivation.

4.2 Perceptions of the stakeholders of ICT diffusion challenges in Nigeria's transport/logistics industry and their roles in modulating them

Interviewees (Table 3) recalled the general lack of application of advanced ICT resources within the industry in the study site. However, most of them acknowledged that larger logistics organisations inherently benefit from the advanced ICT resources more than the smaller logistics operators based on their financial strengths and strategic position in the industry, in terms of regional and international collaborations. Likewise, the socio-economic status of the users was revealed as the major determinant of the demand for customised logistics services, as well as the geographical locations of services, resonating with Ezenwa (2014) who found that there are significant differences in demand for customised logistics services across various regions in Nigeria, based on differences in social-cultural orientations and social-economic status. Whilst the limited logistics performance in the region prevents a complete understanding of ICT facilitated logistics services/operations across the six-geopolitical regions of the country, it is clear from interviewees' responses that operational challenges are particularly problematic for small and medium sized companies.

Table 3 Thematic and magnitude coding result for IEI data

The views of the interviewees concerning factors influencing ICT diffusion among the local logistics operators are demonstrated in Table 3, using summation signs (-/+) to denote negative and positive effects of the identified factors on the propensity of the local 3PL SMEs to acquire relevant ICT resources. Almost all the expert interviewees agreed that the general lack of enforcement/regulation holds back ICT diffusion in the industry, classified as an institutional problem, including extortions by the local enforcement agencies, lack of definite purposes of the leadership of transport/logistics unions, irregular policies, and political instability. The respondents also stressed high cost of capital and infrastructural deficits

categorized as structural problems, as well as the following operational drawbacks: high cost of vehicle maintenance associated with dilapidated road infrastructure, and lack of adequate manpower. Other identified operational drawbacks include limited ICT experience/education status of the owner-managers; lack supply chain collaborations, an unwillingness to pay more for customised services. There was also general agreement concerning how security challenges (terrorist acts and militancy) have disrupted logistics activities in some regions, while few respondents acknowledged geographical challenges (e.g. high temperatures) and cultural challenges (e.g. limited access to recipients during last-mile deliveries).

The respondents generally complained about their inability to modulate (influence) the rate of ICT diffusion in the industry and particularly among the local 3PL SMEs as the majority of them revealed that the locally-evolved issues are mainly linked to institutional failure. In his words, I1 specifically said: "Nigeria Port Authority (NPA) has no authority to enforce implementation of ICT tools among the local logistics operators around Nigeria's seaports, but concentrates on the implementation of safety measure within the port premises and environ." Continuing, I1 said, "based on my experience in this NPA, the local logistics operators lack requisite man-power in terms of mobile mechanic and drivers who can repair or handle basic electronic mechanisms in their vehicles or during discharge of logistics functions, and these issues can be linked to lack of basic infrastructure." Again, I1 revealed thus "the majority of the fleet used by the local freight operators is ancient and cannot be suitable for modern freight activities." Other interviewees buttressed other ICT diffusion drawbacks in the industry, for example, I2 said "we rarely hire the local logistics operators on a permanent basis and cannot extend our internal ICT resources to cover the short-term outsourced logistics services".

The respondent confirmed that contracts are usually initiated through referrals with less official contractual agreements, and simple ICT tools are used (such as mobile phones) to keep track of consignments, which are frequently delayed due to dilapidated road networks, extortion by local law enforcement agencies, insecurity (highway armed robberies, terrorist acts and militancy). The respondent also noted that financial institutions in the study site charge up to 25% for capital. Also, I2 said: "perhaps the extortions of the local law enforcement agencies constitute low logistics performance in Nigeria as man-hours are usually due to unlawful delays on transit." 15, 14 revealed that internet connections were usually disrupted in the regions affected by terrorist attacks/militancy. I3 supported that "the majority of the logistics operators purposely avoid hybrid vehicles due to temperature concerns." As such, there were general concerns about the phasing out of the foreign-sponsored local assembling plants and lack of support for the indigenous automotive manufacturers that would have made fundamental provision for the high-temperature issues. I3 and I4 highlighted that owner-managers with sound education/ICT experience are more likely to improve their scope of businesses technologically. For the union leaders, I1 argued that majority of them are not innovative and inherently resisted previous attempts to innovate the system. On the other hand, the I3 revelation indicated that the union leaders are innovative and educated.

The respondent blamed the government for failing to provide an enabling environment to sustain the industry. He lamented that the circumstances have led to a lack of foreign and local collaborators with the 3PL SMEs as the systems are not conducive to facilitate the business links, aligning with the comment from I2 that food manufacturing companies in the area (e.g., flour mills) typically hire 3PLs through referrals. I3 disclosed that outsourcing firms are usually unwilling to pay more for ICT facilitated services. Further, I4 linked the prevailing problems to lack of unity of purpose among the relevant stakeholders as well as the absence of

long-term strategies/continuity of government developmental plans. Additionally, I5 raised issues concerning cultural challenges (Erumban and De Jong, 2006) and market structure (Caselli and Coleman II, 2001) in the study site. For example, there are cases where the last mile operators are barred from accessing premises to deliver parcels to avoid contact with the residents, hampering provision of customized services relating to online orders.

In sum, the results help to enrich the understanding of salient issues stalling ICT diffusion among 3PL SMEs in Nigeria, especially concerning the roles of stakeholders' reactions in modulating acceptability and rejection of relevant ICT tools. The findings reveal that despite signs of progress in addressing ICT adoption challenges among 3PL SMEs, the reactions of the relevant stakeholders/actors and their roles in modulating the acceptability/rejection of the ICT tools are not well integrated and hence fail to promote improvement in the collective welfare of local 3PL SMEs. Indeed, the chronical presentation in Table 2 indicates that present-day realities may have informed why the lack of ICT implementations persist among the 3PL SMEs. It is important to note that the majority of issues raised in this study culminated to the development of the three-staged ICT diffusion framework (Figure 2) as a long-term road map to improve logistics performance in Nigeria and similar environments.

5. Discussion and conclusion of the research findings

This section presents the discussions of the research findings, based on the two research question of the study; the developed ICT diffusion framework, and conclusion of the study as follows:

5.1 How are the institutional forces shaping ICT diffusion in Nigeria's transport and logistics industry?

Nigeria's transport/logistics sector suffers from relatively poor infrastructure that fails to effectively spur ICT facilitated activities in the region, leading to a low level of regional logistics performance (World Bank, 2018, World Bank, 2013). It is based on this understanding that this study was conceived to shed light on the underlying issues holding back the development of Nigeria's transport/logistics related infrastructure. The findings establish the causal links between institutional voids (irregular intervention/policies and political corruption) and the structural challenges (infrastructural deficits and weak bureaucratic processes). These combine to threaten the operations of the local 3PL SMEs in terms of reduced individual difference factors, limited scope business, and lack of motivation. Several structural challenges burden the local 3PL SMEs as a direct consequence of huge institutional voids in the region, including frequent vehicle breakdowns, associated with the dilapidated road infrastructure, inadequate data management systems, unreliable telecommunication services, and unstable electricity in the region.

Initiatives to improve ICT facilitated services amongst the local 3PL SMEs have often failed as the structural challenges remain persistent. Other locally-evolved challenges identified by the in-depth expert interviews include (i) Institutional voids - lack of enforcement/regulation, extortions by the local law enforcement agencies, lack of definite purpose of the local transport/logistics associations, irregular policies, and political instability. (ii) Structural challenges: high-cost of capital and infrastructural deficits. (iii) Operational challenges: high-cost of vehicle maintenance, lack of adequate manpower, lack of innovative skills of the owner-managers (ICT experience and education status), lack of collaboration, and unwillingness to pay higher for customised services. (iv) Others include cultural challenges

(limited access to recipients during last-mile deliveries), geographical challenges (adaptation challenges of foreign-purchased fleets), and security concerns (terrorism, militancy and highway armed robberies) (see Table 3). These outcomes are consistent with the literature (Apulu and Latham, 2011, Tob-Ogu et al., 2018, Ezenwa et al., 2018, Mondragon et al., 2017). There is strong evidence from our study that when the local 3PL SMEs are overstretched with operational challenges, they lack motivation to acquire relevant ICT tools, a problem compounded by limited scopes of businesses and issues such as ICT experience and educational status (Hitt, 1999). The local 3PL SMEs have diverse socio-economic and geographical concerns stalling swift implementations of the relevant ICT tools to enhance their operations, including lack of willingness to pay higher for customised services, challenges of adaptations of the used foreign vehicles in the region, and cultural barriers. Based on the prevailing circumstances, local 3PL SMEs in the region are unable to secure sufficient ICT resources to bolster their operations/services.

Although our findings indicate that structural challenges create a range of operational drawback amongst the local 3PL SMEs, the primary mechanisms that shape them stem from the institutional voids. Important in this respect are; (i) lack of adequate funding technology innovation, (ii) inconsistency of the transport/logistics infrastructural development, (iii) lack of political will to improve logistics/transport and infrastructure in the region, and (iv) lack of professionalism in the industry as key positions in the sector are often appointed by nepotism.

The combined effects of the institutional voids and the consequential structural problems on the operational characteristics of the local 3PL SMEs (low innovative skills, limited scope of business, and lack of motivation) offer explanatory power in understanding the influences of the institutional voids in region on ICT diffusion process in the transport/logistics industry. The evidence presented in this study demonstrates how lack of ICT innovation adoption among local 3PL SMEs (Gunasekaran and Ngai, 2003, Evangelista et al., 2013) is more likely in the presence of institutional voids (Tob-Ogu et al., 2018, Ezenwa et al., 2018). Scarce transport/logistics infrastructure and weak bureaucratic system (structural challenges) for example prevent the local 3PL SMEs in the region from maximising the perceived usefulness/ease of ICT resources, including other contextual issues presented by the expert interviewees. These align with the dampening effects of the lack of facilitating conditions and limited scope of business on the positive causal relationships between consumer readiness and perceived usefulness/ease of ICT as found in the earlier stages of our research (Ezenwa et al., 2018). It is also the case for the lack of significant mediation effects of the perceived usefulness/ease of use of ICT on the positive causal relationships between a set of exogenous variables (consumer readiness, the scope of business, and facilitating conditions) and the endogenous variables (ICT acquisition and decision quality) (Ezenwa et al., 2018). Although the local logistics operators did not show similar low vulnerability to ICT diffusion challenges due to their differences in scopes of business and innovative skills, in the continued absence of an adequate institutional framework that addresses the structural and operational challenges, the logistics and transport operators in Nigeria would face more operational burdens in future in adapting to the increasing global/domestic logistics and freight demands.

5.2 What are the stakeholders' perceptions of ICT diffusion challenges in Nigeria's transport/logistics industry and their roles in modulating it?

A range of expert interviewees' perceptions highlight the issues affecting ICT in Nigeria's transport and logistics/logistics industry have been identified. These expert interviews indicate how decisions on ICT adoption based on the facilitating conditions and predictive

organisational factors are predicated on the institutional forces existing in the study site, for example, the dismantling of the electronic gadgets of imported fleets due to lack of matching intelligent road systems in the regions. Also, unsuitable temperatures for foreign manufactured vehicles can potentially stall the motivations of the local logistics operators to update their fleet and to acquire relevant ICT.

Because many facilitated logistics services/operations depend on related public infrastructure (World Bank, 2018, World Bank, 2013), the poor public transport/logistics infrastructure in Nigeria tends to limit the local logistics operators to largely reactive responses. This constrains local logistics operators from achieving logistics performance, in terms of freight tracing/tracking, locally and internationally (World Bank, 2018, World Bank, 2013). The lack of basic amenities can lead to a sense of deprivation/vulnerability among the local 3PL SMEs, as reflected in their crude adaptation of ICT resources to achieve specific organisational objectives (Tob-Ogu et al., 2018). With the added burden of the increasing over-head cost associated with high-cost of vehicle maintenance and private sourcing of power supply for example, opportunity to seek alternative sources mitigating the local-evolved challenges are blocked/weakened, in terms of regional or international collaborations, as well as lack of resources to improve innovative skills.

How circumstances might change in future allowing improved logistics performance in the region, for instance through adoption of the paperless logistics operations/services found in other logistics sectors (Air Cargo World, 2017, IATA, 2017) is unclear, due to the persisting nature of the locally-evolved challenges. Therefore, if local logistics operators and the relevant stakeholders lack the predictive power to map the future state of the industry, deciding on operational/strategic plans both in short and long term may be challenging, and could further undermine the propensity of the relevant actors and entrepreneurs to invest in the sector.

Figure 3 Three-staged ICT diffusion framework

Based on this understanding, the three-staged ICT diffusion framework (Figure 3) has been adapted as a potential guide to shaping the future of the Nigerian transport/logistics industry. The framework was conceived based on the three broad themes that constitute the conceptual framework: institutional voids, structural problems, and operational challenges (see Figure 1). The development of this framework also recognises the engagement of the relevant stakeholders in deciding issues that pertain to transport/logistics projects in the region, as well as the need to inculcate enforcement/regulations in the framework as a stimulating factor for improved ICT diffusion in the industry. Moreover, the framework recognizes the need to address public corruption in the sector, in particular the judicious utilization of public funds for infrastructural development and ensuring the right professionals are handling public and private transport administration and management. Additionally, the framework conceptualises the need for improved awareness of the importance of smart logistics services/operations (customised services), especially in the face of increased globalisation of supply chain management (Harris et al., 2015), and the growing focus on the developing logistics markets (Tob-Ogu et al., 2018).

Therefore, the three-stage ICT diffusion framework entails the following: First, establishment of adequate routes through the enforcement of efficiency and accountability in the use of public funds designated for transport/logistics infrastructural developments in the region, continuity of long-term transport/logistics projects beyond political regimes, and appointment of most qualified candidates for public and private transport and logistics

administration/management. The first stage also involves engagement of relevant regulators, policymakers, logistics union leaders, researchers, and transport administrators for holistic understanding and planning of the project from the onset. Second, implementation of paperless transactions among the intermediate stakeholder/actors and collaborators in the industry needs to be promoted. Finally, the implementation of paperless last-mile transactions through enforcement of the necessary regulations and policies is needed. In these stages, enforcement of necessary regulations and policies, as well as the engagements of the relevant stakeholders/actors will be required. It is important to note that the developed framework is not exhaustive but represents a point of entry towards mapping a future for the digitalisation of the transport/logistics industry for Nigeria's transport/logistics industry and similar environments. In doing this, the research design can move beyond merely understanding the stakeholders' perception of ICT diffusion challenges in Nigeria's transport and logistics industry to the consideration of how the various issues identified in this study can be mitigated in a strategic manner.

5.3 Conclusion

This article uses primary information accessed through primary qualitative studies (focus group discussion and in-depth expert interviews) of the relevant stakeholders/actors and professionals in the industry to identify the mechanisms shaping how institutional voids in the study site influence the structural problem, and in turn, increase the operational challenges of the local 3PL SMEs. The study is part of a wider research project mapping smart logistics diffusion strategies in the context of emerging logistics markets, using evidence from local 3PL SMEs activities. The findings identify how institutional voids are responsible for the structural drawbacks in the sector, and in turn, how these constrain the scope of business of the local 3PL SMEs. The study points to several locally-evolved issues requiring assistance to improve ICT diffusion among the local 3PL SMEs, as well as the broader industry. Of particular importance is the assistance that targets the improvement of transport/logistics related infrastructure in the region, including the dilapidated road infrastructure, unstable electricity, lack of efficient data management, and affordable/reliable telecommunication services in the study site. Others include localisation of vehicle assembly and manufacturing plants in the study for the production of the geographically friendly fleets, as well as improving the public and private management of the sector.

The study envisages that the structural and operational threats in the industry can be mitigated through addressing the institutional voids, for example, eradication of public corruption in the sector, as well as ensuring that the best professionals are engaged in the sector. The assistance should also target ways to improve the innovative skills of the local logistics operators, as well as creating awareness of the importance of smart logistics operations/services, in terms of efficiency and clean environment. Besides sparking an academic interest, the research findings presented in this paper have resonance for the logistics practitioners, development actors/entrepreneurs, and policymakers. For the logistics practitioners, the findings of the study and the conceptual model that has been developed from these may be useful in optimising operational strategies. Likewise, for the development actors, the finding of the study may allow identification of investment opportunities that will improve ICT diffusion. Furthermore, policymakers may identify improved strategies based around the developed three-staged ICT diffusion framework that will allow for more sustainable ICT diffusion planning in the sector. The study primarily calls for a reconsideration of the institutional voids characterising the region which are a cause for major concern for local

logistics operators. The nation and its logistics sector need to bridge the gaps in digital innovation to enable local logistics operators to compete favourably in the global market.

The study has some limitations: (i) our study has not covered the customers' view, for example the views of retailers and end-users, and (ii) the sample size of the participants is limited. Nevertheless, it is important to note that the focus group discussion panellists and expert interviewees were purposefully selected for their expertise and experience from a larger sample (120) that participated in the earlier stages of our research programme. Based on these limitations, extension of the work to investigate the customer perspective is recommended.

Appendices

Figure 1: Conceptual framework

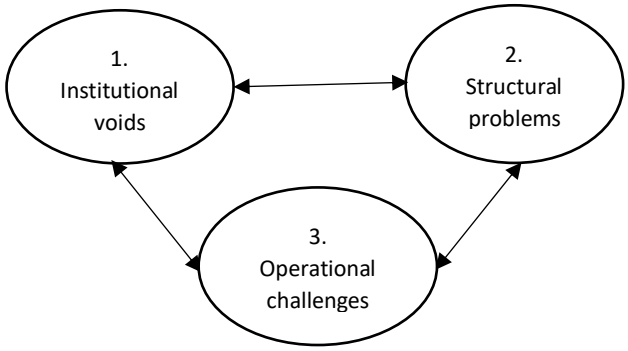
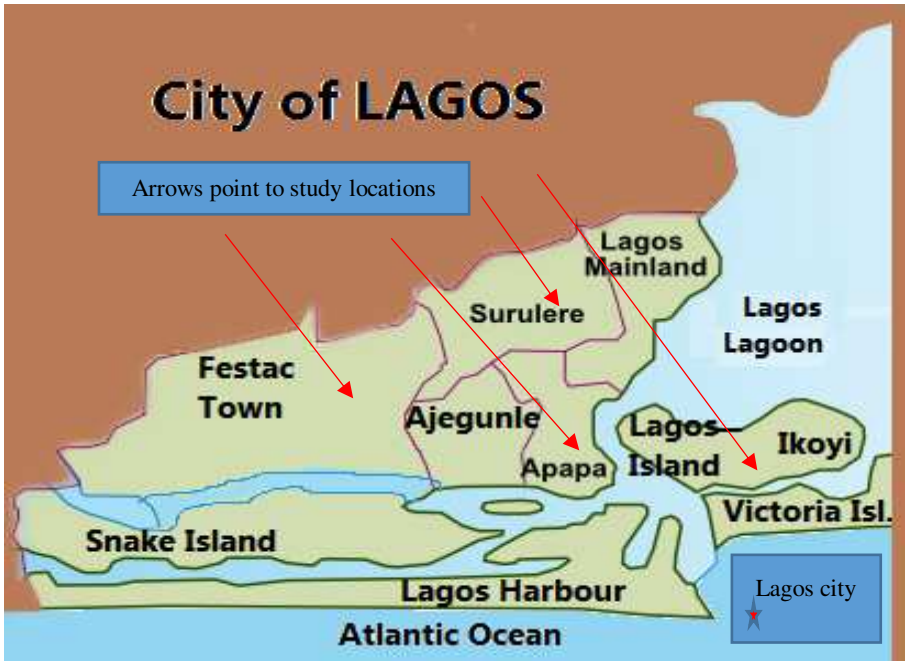


Table 1: Demographic of the respondents

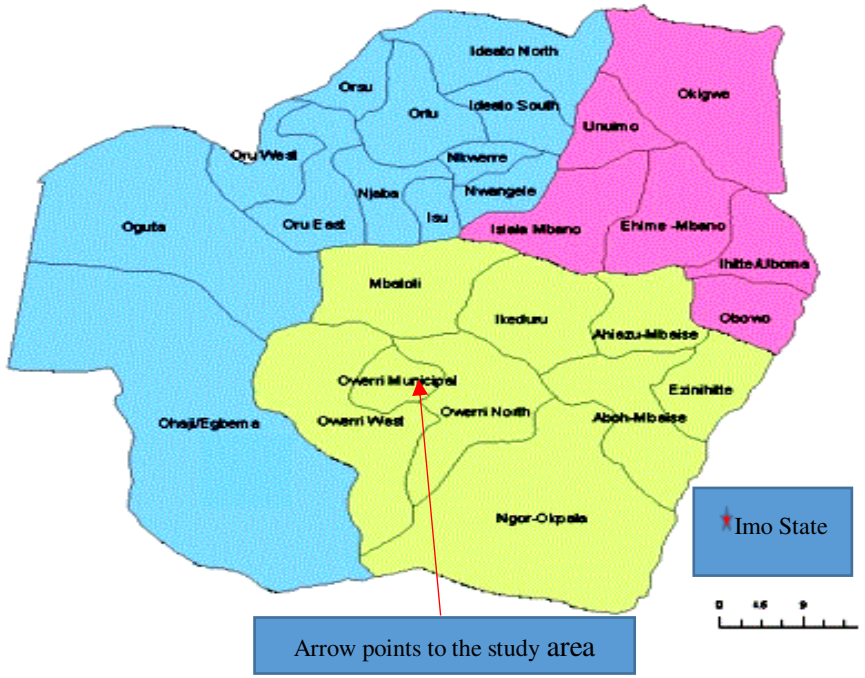
Codes	Organizations	Designations	Years of experience	Education status
	Focus group discussion (FGD) panellists			
P1	Nigeria Shippers Council (NSC)	Senior shipping officer	12	Graduate
P2	Nigeria Shippers Council (NSC)	Shipping officers	8	Graduate
P3	Chartered Institute of Logistics and Transport (CILT)	Chartered member	20	Postgraduate
P4	Higher Institution (University)	Senior lecturer	17	Postgraduate
P5	Logistics firm	Senior analyst	18	Graduate
P6	Logistics firm	Manager	15	Postgraduate
P7	National Maritime Administration and Safety Agency (NIMASA)	Senior officer	14	Graduate
P8	Higher Institution (University)	Professor	25	Postgraduate
	Expert interviewees (EI)			
I1	Nigeria Port Authority (NPA)	Management staff	25	Postgraduate
I2	Flour mills company	Manager	7	Postgraduate
I3	Transport union	President	12	Postgraduate
I4	Transition park	Manager	18	Graduate

I5	Logistics company	Senior ICT personnel	26	Graduate

Figure 2: maps of Lagos and Imo States, indicating study locations



(a) Map of Lagos City
(https://upload.wikimedia.org/wikipedia/commons/9/98/Lagos_Map.PNG)



(b) Map of Imo State
(https://www.google.com/search?q=map+of+imo+state+with+local+government&rlz)

Table 2: Thematic and magnitude and coding results of the focus group discussion

Theme scores	Sub-theme scores	Code scores
Institutional void =29(25.40)	Irregular intervention schemes/policies = 12(40.70)	Low budget for innovations = 4(11.10) Fragmented approach = 8(29.60)
	Political corruption = 17(59.30)	Misappropriation of public fund = 7(25.90) Nepotism = 10(33.40)
Structural problems = 44(38.60)	Infrastructural deficits = 38(86.30)	Unstable electricity supply = 12(27.30) Dilapidated road network = 10(23.20) Lack of adequate data management system = 9(20.40) Lack of adequate telecommunication platforms = 7(15.40)
	Poor bureaucratic process = 6(13.70)	Disorganized sector = 6(13.70)
Operational challenges = 41(36.00)	Reduced individual difference factors = 30(73.70)	Low education status = 18(45.10) Low of ICT experience = 12(28.60)
	Limited scope of business 5(12.20)	Limited scope of business = 5(12.20)
	Lack of motivation 6(14.10)	Lack of motivation = 6(14.10)
Total = 3/144 (100)	7/114 (100)	13/114(100)

* Total of participants = 8; number in brackets are % values

Table 3: Magnitude coding and interpretative analyses results of the in-depth expert interview

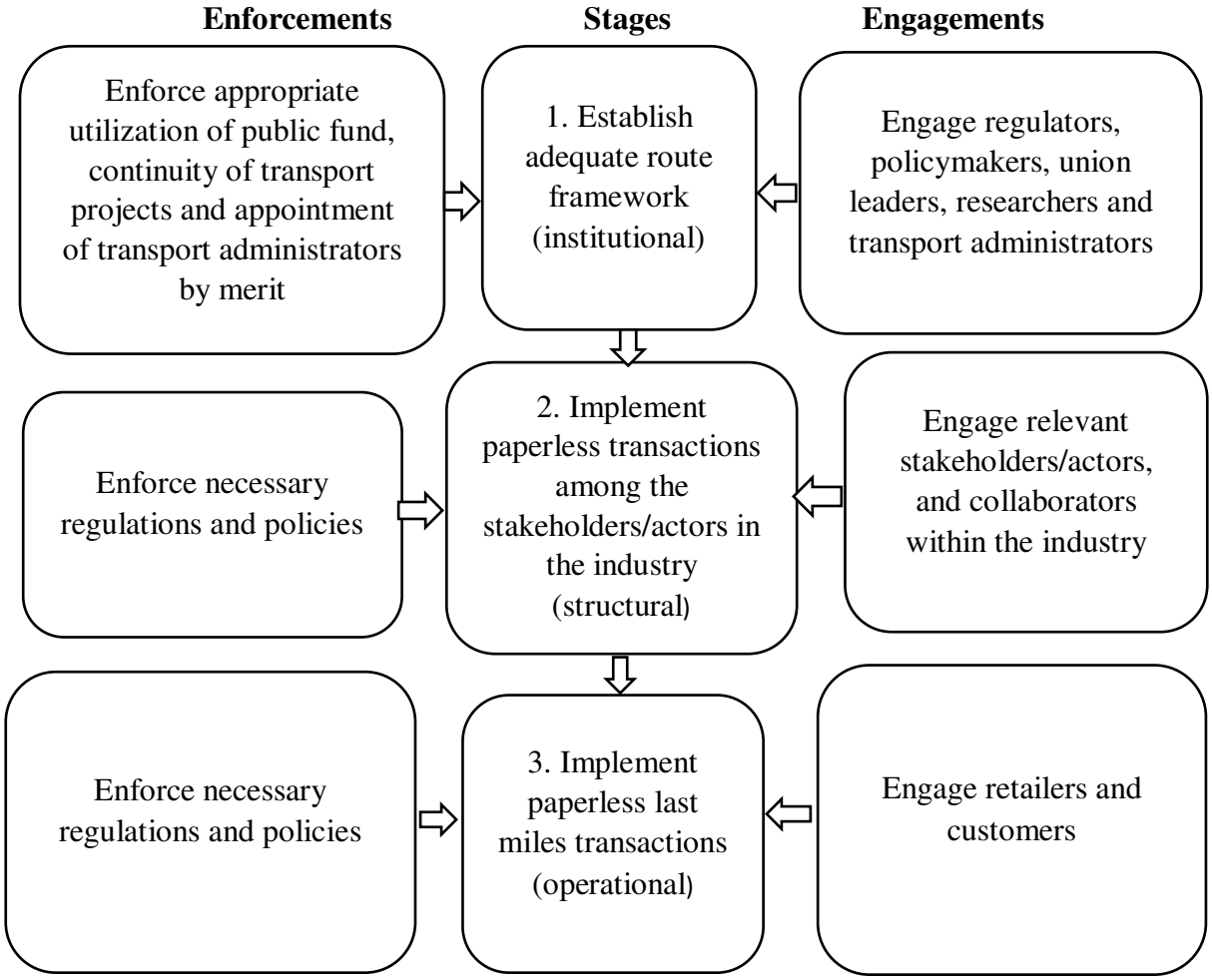
Code No	Key variables (codes)	Interviewees					Themes					
		I1	I2	I3	I4	I5	Institutional	Structural	Operational	Cultural	Geographical	Security
i	Lack of enforcement/regulation	-	-	-	-	-	5 (-)					
ii	High cost of vehicle maintenance	-	-	-	-	-			5 (-)			
iii	Lack of adequate manpower	-		-	-	-			4 (-)			
iv	High cost of capital	-	-	-	-	-		5 (-)				
v	Extortions by the local law enforcement agencies	-	-	-	-		4 (-)					
vi	Terrorism/militancy and highway armed - robberies	-	-	-	-	-						5 (-)
vii	Adaptation challenges of foreign manufactured vehicles	-									2(-)	
viii	Education status	+/-		+/-	+/-	+/-			4 (+/-)			
ix	ICT experience	+/-		+/-	+/-	+/-			4 (+/-)			
X	Lack of definite purpose of the local transport/logistics associations	-		-	+	-	3(-), 1(+)					
xi	Lack of collaborations	-	-	-	-	-			5 (-)			

Table continued in the next page

xii	Infrastructure deficits	-	-	-	-	-		5 (-)				
xiii	Irregular Policies	-	-	-	-	-	5 (-)					
xiv	Unwillingness to pay higher for customized services				-				1 (-)			
xv	Political instability						5 (-)					
xvi	Limited access to recipient during home deliveries					-				1 (-)		

*± responses scoring system

Figure 3: The three-staged ICT diffusion framework (Adapted: IATA, 2017)



Data collection questionnaire and the guiding questions

Focus group discussion (FGD)

Section 1: Demographic characteristics of the participants

Items	Reponses
1.1 Name (optional)	
1.2 Age(optional)	
1.3 Highest level of education	1. None () 2. Primary () 3. Secondary () 4. Higher education () 5. Post graduate education () 6. Others (specify) …….
1.3 Name of organization	
1.4 Designation	
1.5 Years of experience	

Section 2: Introductory questions

2. 1 What are your view about the current transport, logistics, and supply chain operations in Nigeria?

2.2 What are your assessment of the commitment of the Nigerian government towards enhancing logistics performance in the region in terms of the following?

Through policy formulation/interventions	
Infrastructural development	
Funding of technology innovation	
Support/encouragement for local logistics operators	
Others:	

2.3 What are your view about the impact of the advancements of ICT resources with regards to the following?

E-commerce	
Out sourcing of logistics functions	
Supply chain integration	
Activities of the local logistics operators	
Others:	

Section 3: Main questions

3.1 Do you think the rate of ICT diffusion in the Nigeria's transport /logistics industry could reasonably meet the modern logistics and supply chain needs in terms of the following?

International shipments/custom clearance procedures	
Last mile deliveries	
Collaborations among supply chain partners	
Financial transactions	
Provision of customised services	
City logistics	
Globalisation of supply chain processes and integrations	
Others:	

3.2 What have been the major effects of the above identified phenomena on the activities of the local logistics operators, regarding the following?

Scopes of businesses	
Motivation	
ICT experience/training	
Education status/training	
ICT acquisition/decision quality	

Others:	

3.3 How do you think that the relevant stakeholders have intervened ICT diffusion challenges in the Nigeria's transport and logistics sector, with regards to the following?

Regulations/policy actions	
Enforcements	
ICT Training programme	
Moral support or welfare package	
Subsidy/special intervention	
Others:	

Section 4: Concluding questions

4.1 Based on your knowledge and professional experience, what improvement measures by the government and the relevant stakeholders to raise the level of ICT diffusion in the Nigeria's transport and logistics sector?

4.2 What are the expectations of the local logistics operators in the present conditions of the transport and logistics sector and the overall local economy?

4.3 What do think the future of the Nigerian transport/logistics sector would be like if nothing is done regarding the present circumstance?

4.4 Are there other points, revelations, or recommendations you want to share which could help in understanding the study?

In-depth Expert interview (IEI)

Section 1: Demographic information; same as the FGD

Section 2: Introductory questions; same as the FGD

Section 3: Main questions

3.1 Who are the main users of ICT resources in the industry in terms of larger verses smaller logistics organisations and logistics service providers' verses users?

3.2 What activities are you involved to stimulate ICT diffusion in the industry, particularly among the local 3PL SMEs

3.3 How would describe rate of ICT diffusion in the industry and what are major barriers of ICT adoption among the local 3PL SMEs regarding the following?

Finance	
Operations	
Geographical	
Social -economic	
Ethical- cultural	
Political and environmental	
Others:	

3.4 What changes have you seen over the years relating to the question 3.3?

3.5 If there has been changes, what are the causes as regards to the following?

Regulations/policy actions	
Enforcements	
Collaborators' or unions' influence	
Scopes of business	
Customers' demand	
Others:	

3.6 Following the widely acknowledged lack of logistics performance in Nigeria, would you say there has been improvement or plans towards improving it?

3.7 In your opinion, how has ICT resources impacted the activities of the local 3PL SMEs?

3.8 With ICT adoption been linked to the logistics performance, would you say there is evidence in the activities of the local logistics operators to support these? What are the evidences to support these (if there are?)

3.9 Please state the conditions with regards to questions 3.3 that make this possible

Section 4: Closing questions

4.1 What are some intervention measures that have been adopted by your organization in dealing with ICT diffusion challenges in the industry and the local 3PL SMEs in particular?

4.2 Are the institution/government doing anything to make ICT resources accessible in the industry and the local 3PL SMEs in particular? If yes, please provide explanations on how these have been done?

4.3 Are there policies in place that deal with ICT diffusion challenges in the industry? If yes, do you view that they have been implemented or how well they have been implemented?

4.4 In your opinion, how can ICT diffusion challenges in the industry be integrated into the national IT policy initiatives and strategic goals?

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