

THE IMPACT OF DIGITIZATION ON INTERNATIONAL LOGISTICS: CHALLENGES AND OPPORTUNITIES IN DEVELOPING ECONOMIES

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Summary

In response to the persistent advancement of technology, various business sectors are progressively adopting digital paradigms through the incorporation of software systems into their operational frameworks. This shift is notably driven by the substantial online presence of a growing customer base, compelling businesses to integrate automated systems that align with contemporary requirements. Regrettably, the ubiquity of technological evolution is not uniform, with certain developing nations still reliant on manual processes. This research paper is dedicated to scrutinizing the imperative for comprehensive digital integration within the logistics systems of developing economies. The objective is to evaluate the challenges associated with introducing such innovations and propose viable strategies for their effective implementation. The examination of these facets aims to shed light on the potential disparities in technological adoption across different regions and provide insights that can contribute to a more balanced and accelerated technological evolution in the global business landscape.

Keywords: international logistics, digitization, technology, digital transformation, automation.

Introduction

The Information and Communication Technology (ICT)-driven digital economy has emerged as a major global economic force, significantly influencing economies around the world. Despite its undeniable impact, accurately defining and measuring its effects on national economies remains a complex task, as highlighted by A.A. Oloyede et al (2023). The rapid evolution of technology globally has led to a paradigm shift in various industries, transitioning from traditional manual approaches to predominantly automated and digital operations. Industries have eagerly embraced technological advancements, exemplified by the integration of automated features, such as e-learning, enabling individuals to pursue education globally. These instances underscore the effectiveness of technology in streamlining operations across diverse sectors. Focusing specifically on logistics, a critical component of every economy, the potential gains from incorporating digital innovations warrant careful examination. Logistics, responsible for establishing distributive networks of goods and services within and between nations (international logistics), plays a pivotal role in global trade. However, the unfortunate reality is that technological advancements are more prevalent in certain countries, leaving others grappling with slower manual processes in this sector. This paper is dedicated to thoroughly explore the necessity for complete integration and implementation of digital technologies within the logistics sector of developing economies. It aims to scrutinize potential challenges in the implementation process and subsequently present strategic solutions to effectively address and transform these challenges into opportunities. Through this exploration, the paper seeks to contribute to the ongoing discourse on the digital transformation of logistics in developing economies.

Research aim: To determine the impact of digital integration in international logistics. The following **objectives** were derived from the aim:

- To examine the benefits of digital integration into international logistics
- To assess the challenges of digital integration on the efficiency of international logistics operations
- To determine ways forward in ensuring effective digital integration in developing economies

Research object and methods

This research article adheres to a qualitative methodology grounded in a structured research strategy, offering a framework to investigate analogous areas of interest and fostering an environment conducive to subsequent studies and analysis. The primary emphasis lies in the deliberate application of secondary analysis to extract nuanced, comprehensive, and adaptable insights from comparable sources. A meticulous examination of these sources was undertaken in alignment with the research problem, culminating in the formulation of propositions pertinent to the specified research challenge.

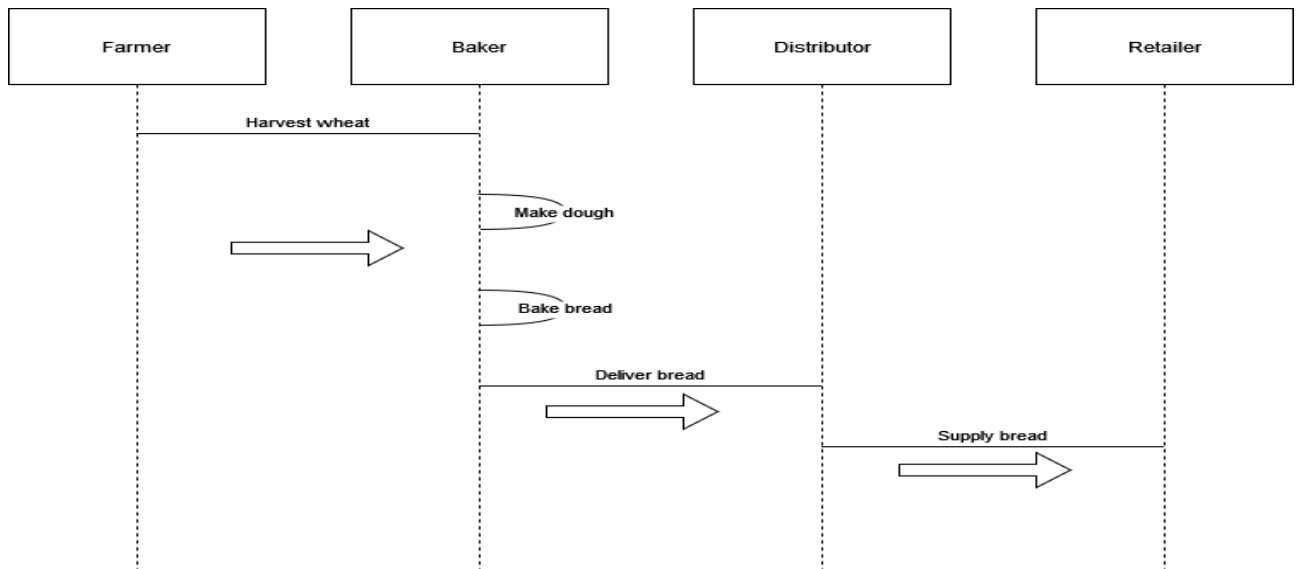
Research results and discussion

It will not be lucrative to discuss on the impact of digital integration in logistics without ascertaining the meaning of the term in question. The concept of logistics has been defined by various scholars such as Christopher (2016), and Phillip Kotler (2016), among others. Despite differences in wording, these definitions converge on a common theme, emphasizing the strategic coordination of planning, implementation, and control of physical material and finished goods flows from origin to destination, ultimately aimed at satisfying customer needs while ensuring profitability. This

perspective underscores the ubiquitous presence of planning and control, transportation and exchange, consumption, and, ultimately, the satisfaction and profitability of both customers and companies. The intricate interplay of these elements constitutes a dynamic process involving multiple stakeholders working collaboratively to achieve the overarching goal. Consequently, any disruption or challenge at any stage has the potential to disrupt the entire logistics process, leading to a deviation from the primary objective of customer satisfaction. Logistics, as an integral component of international trade, serves as the vital link connecting countries through the intricacies of importation and exportation processes. This therefore cements the idea of international logistics, which is that part of logistics that functions across national borders. This equally goes to expose how nations are able to consume what they cannot produce because of the international logistics process, which comes into play to facilitate this exchange process. And to mention that this process only caters for the effective transmission of the produce from point of origin to destination, it will be imperative to examine how these said produce are generated before being processed through the logistics framework.

That brings us to the concept of production, a process that is responsible for creating goods and services to satisfy human wants. Alternatively, Frisch (1965) restructured the term production by defining it as technical production in which he said is a transformation process which can be directed by human beings, or which human beings are interested in, a transformation, which a certain group of people consider desirable. The term transformation indicates that there are certain things (goods or services) which enter into the process, and lose their identity in it, i.e. ceasing to exist in their original form, while other things (goods or services) come into being in that they emerge from the process. This was equally confirmed by Yasanur Kayikci (2023) who stated that the focus of the digital transformation lies mainly on production. Diving deeper, it is essential to examine the different categories, with the first being referred to as production factors (input elements), while the last-named category are referred to as products (the output or resultant elements). The grain put into the ground, manure, etc., are production factors, while the harvest is the product. Wooden materials and the carpenter's work are production factors, while the chairs and the tables are products. The transformation, which we call production in the technical sense of the word, need not alter the actual material qualities of the things concerned. Often it need only be a movement, a selection or a conservation ('a movement in time'). Logs lying in the forest are not the same things as logs at the sawmill. The process of hauling the logs to the river, floating them down, and getting them to the sawmill is just as much production in the technical sense of the word as the business of felling the trees and stripping the bark off the stems. The same is true of the selection and conservation e.g. of vegetables and fruit. From the purely technical point of view production in the sphere of trade consists to a large extent of selections or movements in time and place. Note that here we are only speaking of the facts that affect the process of transformation, which can be described quite objectively in technical terms, e.g. 'a table executed by a carpenter', 'logs lying at the sawmill,' 'apples in January', etc. When speaking of production in the technical sense, we are in fact not always concerned with the extent to which it is possible to measure the 'value' or 'use' which production creates. Thus if, for example, a product suddenly becomes valueless, owing to the state of the market, we can nevertheless say that the process that produced it was a production in the technical sense of the word. Nor do we in this connection try to find out whether the transformation is hygienic or morally justified or not. The process that takes place in a tobacco factory we should call production in the technical sense of the word, even though there are a great many people who consider that tobacco is harmful. Even the armaments industry constitutes production in the technical sense. Thus, it is safe to adhere that for the logistics process to be practicable, it is essential for goods to be available. The availability of these goods emanate from the production process which, from analysis, demonstrates the various stages in which a good passes through before being ready for consumption or the market. From the annotated insight above, it is important to appraise these stages, commencing from the primary stage, also known as the extractive stage.

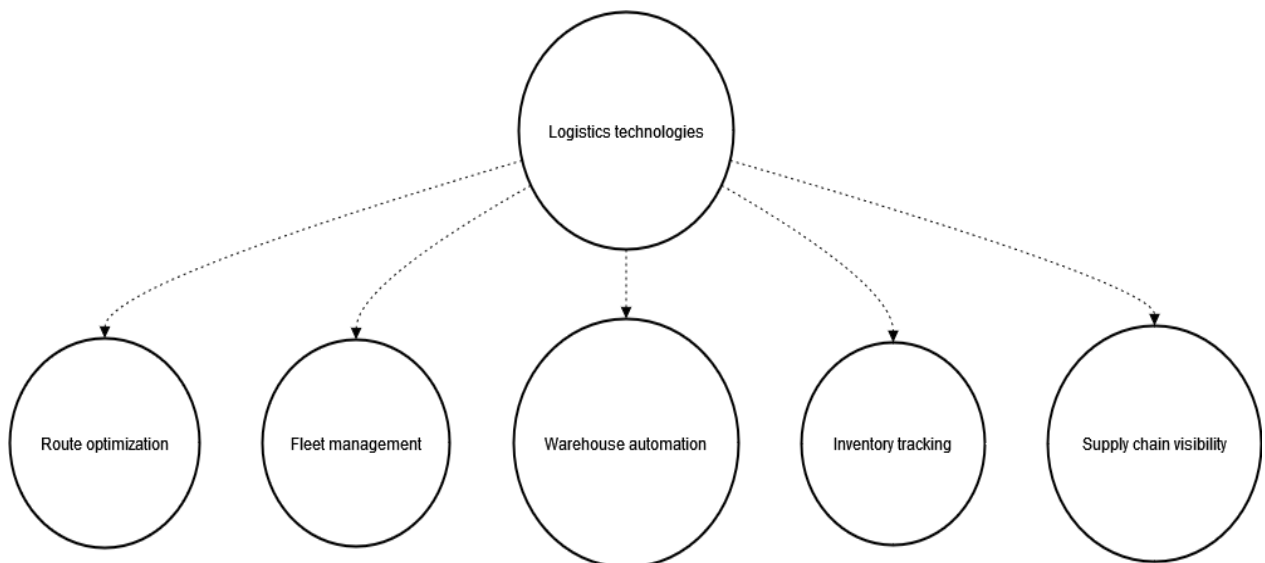
- **Primary sector:** This sector in a production process actually defines the initiation of the entire flow and it simply involves getting access to the raw materials from the gifts of nature. It should be noted that all or most of what we consume today has actually undergone some transformation after they were gathered in their natural forms.
- **Secondary sector:** This stage is also known as the transformation sector, in which all the raw materials acquired from the primary stage are processed to either semi-finished or finished goods. Once the transformation is deemed completed and the goods are ready for the market, the next stage sets in.
- **Tertiary sector:** At this stage, we are more concerned with ensuring that the goods, which have been produced, are sold to the consumers in the market. This process involves marketing and advertising to ensure the goods stand out from that of competitors, and then closing the deals through actual sales. This stage also ensure that the production is completed as the goods produced finally reaches the consumers. To effectively narrate this process, we will examine its actual application in which all stages will be clearly defined by demonstrating the production process of bread. The sequence of diagrams below displays more about this process:



Source: According to Author (2024)

Fig. 1. Figurative display of bread production

Figure 1 demonstrates the production process of bread, spanning from the extraction of a component of the raw materials from the fields, transporting to the factory for processing into flour, from where bakers will purchase and use to bake bread, and then distribute to wholesaler and retailers for sale. The primary stage is marked at the extraction of wheat, followed by the secondary stage which involves transforming wheat into flour and then into bread, and lastly the tertiary stage, where the service of distribution and retailing is carried out to put an end to the production process. It should be stressed here that the aspect of logistics plays a vital role in ensuring the smooth functioning of the production process. Transportation, storage and warehousing are some of the logistics activities which act together to ensure a smooth production process. While the primary focus of digital transformation often centers on production, terms such as "Factory of the Future" or "Smart Factory" are synonymous with this overarching concept. It is crucial, however, to recognize the profound implications of digitization in logistics and the pivotal role of the supply chain. It should be noted that the application of Industry 4.0 technologies and technological concepts to logistics processes is termed 'Logistics 4.0' (Manuel and Patrick, 2021). Industry 4.0 aims at merging information technology with production and logistics processes (Kagermann H. et al, 2021). The essence of the fourth industrial revolution lies in its commitment to realizing real-time full-transparency throughout the entire supply chain, extending from suppliers to end customers. This involves accommodating small lot sizes, managing multiple product variants, facilitating connected processes, and embracing decentralized, autonomous management (Yasanur, 2018). Such transformative benefits, integral to the vision, transcend production boundaries and can only be fully realized when implemented across the entire supply chain. Thus, it is primordial for the logistics domain to broaden its perspective in order to align with the requisites of Industry 4.0, incorporating suitable technologies and fostering vertical and horizontal integration among logistics partners.



Source: According to Author (2024)

Fig. 2. Display of logistics technologies

An essential aspect, which is vital in this analysis, is the fourth stage known as Quaternary stage. It is that stage, which defines the blurring lines between physical and digital activities, thus encompassing the attributes of the fourth industrial revolution or industry 4.0. According to A.A. Oloyede et al (2023), the digital economy, driven by Information and Communication Technology (ICT), has emerged as a significant contributor to economies worldwide. Thus this sector is more immersed in ensuring that the working process of every organization is intensively automated by instituting digital innovations to facilitate daily activities. Most often, it is confused with the tertiary based on the fact that they both render services, however it stands out in that the services of Quaternary activities are intellectual rather than repetitive activities and are geared towards instituting high level digital processes to scale the operations of any business into the scope of the digital evolution. Within the framework of international logistics, digital innovations have been initiated various capacities to ensure that the entire logistics process, ranging from local to international is strategically fit to meet established objectives. These innovations are being designed to fit into the different steps in the logistics framework like warehousing, storage, and transportation with emphasis on each of the different transport modes. To expatiate, it will be imperative to present an annotated figure as shown below:

An up to date logistics process is one which meets the need of the 21st century business environment, characterized majorly by digital innovations. Spanning from transportation, a phase that establish connectivity between the raw materials and factory, and factory to the market, an enhanced transport system should be embedded with innovations such as GPS technology and telematics system which facilitates real time vehicle tracking, route optimization and also provides deeper insights into the vehicle performance. The warehouse is also another vital component in a logistics process that facilitates storage, sorting and effective management of inventory. The implementation of digital innovations such as warehouse management system, automated picking tools and automated inventory systems facilitates the activities and operations in the warehouse. These innovations play huge roles in enhancing the effectiveness of the logistics process, thus increasing productivity and efficiency. The supply chain process, being a network of all stakeholders involved in the extraction, transformation, distribution and exchange of goods is equally fundamental element as far as logistics is concerned. With the manner in which technology is penetrating into various processes, digitization has brought about a notable impact on supply chain performance, with the introduction of cutting-edge technologies such as the Internet of Things (IoT), blockchain, and artificial intelligence (AI). These technologies enable real-time tracking of goods, automation of processes, and data analytics for informed decision-making. As a result, supply chain visibility, efficiency, and responsiveness to customer demands have been significantly enhanced, leading to reduced lead times and costs (Pavlyuk, 2023). These incites an idea to explore on the merits, challenges and propositions to unravel these challenges when such innovations are initiated into the logistics process of developing economies. Some of the culminated merits as proposed by the author for digital integration in logistics could be summarized as follows:

- **Collaboration and Connectivity:** Digital integration facilitates seamless communication and collaboration among various stakeholders in the supply chain. Cloud-based platforms and collaborative tools enable real-time sharing of information among suppliers, manufacturers, logistics providers, and retailers. Improved connectivity leads to better coordination, reduced lead times, and increased responsiveness to changes in demand or supply chain disruptions.
- **Efficiency and Automation:** It is quite obvious that the initiation of digital technologies into the logistics process streamlines and automates various processes in logistics, reducing manual interventions and minimizing errors. Technologies such as RFID, IoT devices, and automated systems enhance the efficiency of tasks like inventory management, order processing, and shipment tracking. Automation helps in accelerating processes, reducing lead times, and improving overall supply chain efficiency.
- **Real time visibility and tracking:** The automation of the transportation domain helps to provide real-time visibility into the entire supply chain. Through technologies like GPS tracking, sensors, and advanced analytics, logistics stakeholders can monitor the movement of goods at every stage. This visibility enables better decision-making, helps in proactively addressing issues such as delays or disruptions, and enhances overall supply chain transparency.
- **Data driven decision making:** The decision making framework is eased as the initiation of digital technologies into the logistics process automatically generates and collects vast amounts of data throughout the logistics process. Analyzing this data allows for data-driven decision-making. Predictive analytics can help in forecasting demand, optimizing routes, and identifying areas for cost reduction. Access to actionable insights enables logistics companies to make informed decisions, enhancing overall operational efficiency and competitiveness.
- **Customer satisfaction and experience:** The end result of the entire logistics is to ensure mutual benefit for both the company and consumers, with consumers being the actual focal point since they define the market for all that is produced and distributed. These digital innovations enhances the customer experience by providing accurate and real-time information about the status of orders, shipments, and deliveries. Customers can track their orders, receive timely updates, and have better visibility into the entire logistics process. This transparency and improved service contribute to higher customer satisfaction levels and can be a competitive advantage for logistics companies.

From the highlighted points, it is evident that digital integration in logistics offers efficiency gains, real-time visibility, data-driven decision-making, enhanced collaboration, and improved customer satisfaction, ultimately leading to a more agile and competitive supply chain. However, it is also unfair that most of these innovations tend to be more predominant in developed countries, thus boosting their logistics systems and efficiency, while that of developing economies still bask in traditionally manual ways of doing things. As a result of this deficiency in digital inclusion, the productivity is often below potential level. A number of ideas were developed by the author and reviewed to be setbacks in digital integration in the logistics sector of developing economies. These include:

- **Limited Access to Capital and Resources:** This constitutes the major setback limiting the digital potential of logistics stakeholders in developing economies. Many businesses in developing economies may face financial constraints, limiting their ability to invest in advanced digital technologies. The initial costs associated with implementing digital integration, including purchasing and deploying technology infrastructure, can be prohibitive for smaller logistics providers. Limited access to capital and resources becomes a significant hurdle in adopting digital solutions that could otherwise improve operational efficiency and competitiveness.
- **Infrastructural Limitation:** Most developing economies may lack the necessary digital infrastructure, including reliable internet connectivity, advanced communication networks, and data storage capabilities. Inadequate infrastructure can hinder the implementation of technologies such as IoT devices, RFID, and real-time tracking systems. Without a robust technological foundation, achieving seamless digital integration becomes challenging, impacting the efficiency and effectiveness of logistics operations.
- **Skill gap and change management:** The successful implementation of digital integration requires a skilled workforce capable of managing and utilizing new technologies. Developing economies may face a shortage of professionals with expertise in digital technologies, data analytics, and supply chain optimization. Additionally, resistance to change within organizations can impede the adoption of digital solutions. Addressing skill gaps and implementing effective change management strategies become crucial for ensuring successful digital integration in the logistics sector.
- **Regulatory and compliance barriers:** Developing economies often have complex regulatory environments and may lack standardized protocols for digital integration in logistics. Regulations related to data privacy, cybersecurity, and technology standards can vary, creating challenges for companies trying to implement cohesive digital strategies. Navigating these regulatory barriers requires significant effort and compliance, which may slow down the adoption of advanced digital technologies in the logistics sector.

Overcoming these challenges in developing economies requires a multi-faceted approach that involves collaboration between the public and private sectors, investment in infrastructure development, regulatory reforms, and efforts to enhance digital literacy and skills within the workforce. Successfully navigating these challenges can unlock the potential benefits of digital integration, leading to more efficient and resilient logistics operations. Thus a number of ideas were culminated as proposed below:

- **Investment in education and training programs:** Implementing education and training programs focused on digital skills for the logistics workforce can address the skills gap. Governments, industry associations, and educational institutions can work together to provide training initiatives that empower employees with the necessary knowledge to handle digital technologies.
- **Implementing modular solutions:** To address cost constraints, logistics companies can adopt scalable and modular digital integration solutions. Instead of large, upfront investments, they can start with smaller implementations and gradually scale up based on their needs and financial capabilities. This phased approach allows for a more manageable adoption of digital technologies.
- **Advocacy for regulatory reforms:** Industry associations and stakeholders can advocate for regulatory reforms and the development of clear standards for digital integration in logistics. Engaging with policymakers to create an enabling environment for the adoption of digital solutions, while ensuring compliance with relevant regulations, can help overcome regulatory and compliance challenges.
- **Public-private partnerships for infrastructure development:** Governments and private sector entities can collaborate to invest in and improve digital infrastructure. Public-private partnerships (PPPs) can help fund the development of reliable internet connectivity and support the implementation of digital technologies in the logistics sector.

Conclusions

1. The incorporation of digital innovations into various business processes, with a specific focus on logistics, is imperative in the current landscape characterized by the rapid evolution of technology. This imperative is underscored by the pervasive influence of technological advancements that compel businesses to integrate digitization into their operational frameworks. Such integrated innovations yields a plethora of advantages, including heightened operational efficiency, superior decision-making capabilities, and an elevated level of customer satisfaction.

2. While appraising the wins, it should be stressed that such benefits are often accompanied by certain shortcomings. In emerging economies where the level of digital implementation and usage is still below optimum, ensuring efficiency in logistics operation becomes challenging as well. This is equally coupled with a myriad of challenges, encompassing insufficient infrastructure, financial constraints, a dearth of skilled personnel, and apprehensions regarding security, pose impediments to the seamless implementation of digital solutions. While digital implementation is crucial to ensure successful and improved modes of operations, these other infrastructural elements collectively complements the efficacy of technological innovations. For example, the implementation and use of automated systems will be insufficient without sufficient electricity to power the system, finance to ensure continuous implementation and other complementary gadgets.

3. Addressing these challenges necessitates a comprehensive strategy. Public-private partnerships can effectively mitigate infrastructure limitations, while initiatives focused on capacity-building and incentivization can alleviate issues

related to skill shortages and financial constraints. Additionally, the establishment of stringent information and data regulations, accompanied by supportive mechanisms, becomes imperative to safeguard digital systems. This constitutes a vital phase in digital inclusion, coupled with the rate of phishing lately, which creates an unsafe environment for big data. In the pursuit of digital integration, emerging economies have the opportunity to surmount traditional logistical challenges, leapfrogging into the establishment of modern and efficient supply chain networks. By strategically confronting these challenges, governments, businesses, and industry stakeholders can lay the groundwork for a more resilient and technologically advanced logistics sector. This, in turn, contributes to overall economic growth and enhances competitiveness on the global stage.

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