

The impact of digitalization on the transformation of postal and logistics systems

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Abstract

The process of business digitalization has become inevitable for most industries. The logistics sector, one of the fastest-growing in the world, is also facing this challenge. Networking of all segments of the logistics and postal system through digitalization offers a lot of potentials to reduce costs and increase efficiency. The paper analyzes the possibilities for digitalization of business. Special attention is paid to some of the technologies that can be applied in the field of postal traffic and logistics. Also, there are some difficulties in initializing the digitalization process, that have been described.

Keywords: Digital transformation, Logistics system, Postal system, Technologies

1 Introduction

The world is on the cusp of a new digital era. Digital transformation (DT) has emerged as an important phenomenon in research in recent years. It encompasses the profound changes taking place in society and industries through the use of digital technologies [1], [2].

Modern studies consider the DT mostly as a combination of effects arising under the influence of several implemented digital innovations. The result is the emergence of new economic structures and business practices, as well as new values and beliefs in the business environment [3]. Numerous studies have considered diverse aspects of DT [4]-[6].

Digitization is a step towards digitalization, which is about implementing new business models that have new value propositions. Organizations can be achieved this if they incorporate digital workflows and processes, have integrated systems that assist in better coordination and analytical operations, and remain open to embracing future technologies [7].

Cuenca et al. [8] described that a successful DT is related to four main factors:

- Clear process definitions;
- Defined implementation steps;
- People training;

- Standardization of the implementation process.

Brennen and Kreiss [9] and Ritter and Pedersen [10] define digitalization as „the exploitation of new technologies with processes to gain a competitive advantage and the potential to transform the logistics and supply chain sector”. Digital innovation enables logistics players to drive efficiency and lower costs, as well as pursue new business opportunities [11]. Digital technologies can increase sales of services [12], as part of the offer of added value, thus meeting the needs of customers by offering innovative solutions, and creating a database of user habits.

DT has a major impact on all activities carried out by those organizations that adopt it. It offers opportunities for the growth of commercial, government, and public organizations, and it requires the full attention of business and information managers [13].

At the organizational level, companies must find ways to innovate processes with technologies by devising “strategies that embrace the implications of DT and drive better operational performance” [14].

2 Digitalization postal and logistics sectors

The postal system has been one of the first sectors to experience the effects of digitalization on traditional business models. Strong competition forced them to be innovative and efficient and to diversify their activity. Postal operators around the world have invested heavily in new operational technologies to reduce costs and increase operational efficiency [15].

DT of postal services has become a strategic priority as the digital economy is expanding. Postal operators worldwide are implementing new technologies to modernize, diversify and adapt services to customer demand [16]. DT provides opportunities to ensure their long-term relevancy and creates new sources of revenue. According to Universal Postal Union (UPU) research, over 93% of Posts provide some form of digital postal services either directly or in partnership with other companies to be agile. In that way, they share risks and reduce financial burdens. 73% of Posts indicate an increased investment in digital postal services. From basic digital postal services such as online track and trace, e-post through to e-government and e-commerce services (digital identities, national marketplaces, e-payments, and e-logistics) innovation continues at a pace [16]. Posts can help governments implement international, regional, and national digital transformation strategies. They are becoming key to ensuring digital inclusion for every society. The UPU is piloting projects to connect developing countries with the UPU's digital networks through the Customs Declaration System, International Postal System, and other IT tools [17]. The new digital era will require changes to existing legal and regulatory.

DT of logistics is reduced to the construction of specialized Information Technology (IT) platforms that allow for major changes in the logistics activities of enterprises. Digital progress has the most obvious impact on transportation [18].

DT plays an increasing role in the logistics and supply chain (L&SC) industry [19]-[21] and offers a wide range of opportunities for industrial logistics [22], [23]. Companies such as Amazon have fundamentally changed L&SC industry landscape through digital products and services [24]. They thus have embraced digitalization as a force of change and as an opportunity to create

completely new products and services [25]. On the other part, sea or rail freight forwarders are still characterized by low levels of digitalization and manual processes [26]. In the past, logistics players such as DHL, Kuehne + Nagel, DB Schenker, UPS, and Nippon Express operated in a stable world, where efficiency, standardization, and low cost were the keys to success. However, digitalization has changed this focus, transforming the market. New, digital-native entrants are more able to adapt to emerging imperatives such as agility, customer centricity, and the need to constantly innovate [11].

3 Technologies

Digital technologies have shrunk the economic boundaries and the world is becoming a global village. The integration of information and communication technologies and the global connectivity of these technologies have enabled computers, telecommunication devices, and networks to collaborate and work together (exchange information) locally and globally [27].

Some authors deemed some technologies as key enablers for the DT postal and logistics sector [7], [28]. That technologies are: Blockchain, Artificial Intelligence (AI), and Cloud Computing.

Technologies like sensors, robots, automation, cloud computing, data analysis, 3D printing, autonomous vehicles, artificial intelligence, or blockchain technology supplement but do not replace the real world of logistics. They provide customers with higher logistics service value [29].

Technology allows increasingly accurate forecasting of requirements (including necessary capacity, personnel time, and other operating expenses) [11]. Delivery innovations, such as the use of parcel lockers and electronic signature capture are being developed to provide flexible delivery.

3.1 Blockchain

Blockchain is an open, global infrastructure that allows companies and individuals making transactions to cut out the middleman. This reduces the cost of transactions and the time-lapse of working through third parties. Technology is based on a distributed ledger structure and consensus process. The structure

allows a digital ledger of transactions to be created and shared between distributed computers on a network. The ledger is not owned or controlled by one central authority or company and can be viewed by all users on the network [30].

Advantages of blockchain can be very useful for use in modern logistics systems due to the following characteristics [31]:

- Public availability and transparency provide the ability to monitor products from suppliers to end customers;
- Decentralized structure provides the possibility of participation of all parties in the supply chain;
- Cryptography and immutability provide a greater degree of security.

This technology allows smart contracts to work. The nature of the functioning of smart contracts and their compatibility with the IoT concept enable high applicability in the logistics industry. Within the logistics industry, smart contracts can be used for [32]: granting letters of credit, creating electronic consignment notes, inventory management, monitoring of products by all participants, monitoring of cargo sensitive to temperature changes, etc. Blockchain has been implemented in companies that deal with logistics, but which are very different from each other in terms of development, market presence, approach and way of doing business.

The postal and logistics management community realizes how profoundly Blockchain could affect their industry. Blockchain can increase the efficiency, reliability, and transparency of the overall supply chain, and optimize the inbound processes [33]. It can significantly reduce costs.

Under its .POST Group (DPG), the UPU has launched a new blockchain project aiming to create a digital marketplace to trade, host, and track crypto-stamps. The project allows for creating, developing, and operating a digital stamps marketplace, which will use blockchain for transactions such as issuing, trading, collecting and paying for crypto-stamps [17], [34].

Regarding digital public services, in particular, those provided by postal operators - blockchain is a big opportunity. Because of its unique characteristics (traceability, immutability,

transparency, and decentralization), it is a way to efficiently redesign these services. However, the different blockchain applications raise issues related to the legal framework in place. Thus, regulatory issues must be taken into account for the efficient use of blockchain [35].

By applying blockchain technology, postal operators could become the leading service for money transfers in the country and abroad. This would encourage the exchange of funds in cryptocurrencies in a decentralized payment system. Along with IoT and RFID tags on shipments, blockchain would improve visibility and transparency, not only for operators but also for customers who can track goods in real-time [36].

3.2 Artificial Intelligence (AI)

AI improves capacity, flexibility, reliability, safety, energy efficiency, and cost-effectiveness in many industries, so in the postal and logistics sectors. AI could improve the efficiency of transportation and optimize performance in warehousing operations. By collecting and analyzing data, AI could predict inventory, flows of materials, demand, and supply, as well as other factors in business and technology.

AI technology may impact the operations of the postal sector by using drones, robotics, and automated machine to communicate with customers. Also, can assist the supply chain, and improve transport services [37]. It can be used: to improve the parcel and mail handling process; the collecting, sorting, tracking; and last-mile delivery of postal mail [38]. In some automated centers, an optical character recognition image and fingerprint digitization constitute a unique identity called biometric technology.

Implemented AI in distribution centers can enhance the quality of the logistics process and can increase human capabilities. AI improves product monitoring: traceability, locating, control flow. In addition, it can significantly improve the work environment and minimizing accidents at work [39]. AI makes the warehouse more dynamic, more agile, and more responsive [40]. The possibilities of applying AI technologies are numerous. Small mobile robots can bring shelves or bins of articles to an order-picking station. Robotic arms can use for palletizing or depalletizing. Inventory drones can crisscross the aisles of shelves. Exoskeleton-type

frames can handle assistance. Connected glasses or augmented reality help for picking by vision, and connected gloves for scanning parcels [38].

According to the ABI Research [41] released in 2019, more than 4 million commercial robots will be installed in more than 50.000 warehouses worldwide by 2025. Robotics was designed to offer “last mile” delivery solutions to businesses and communities. Each robot can be programmed to automatically move through pedestrian areas and delivery from the pick-up point (kiosks, stores) to the delivery point (the customer's home). Robots may inside warehouses perform tasks that are risky, tedious, or repetitive. This allows people to focus on things that are creative and that are less manual [42].

One powerful type of AI is the vision sensor system. This is a field of computer science that reconstruction of complex parts of the human visual system. It can identify, track, measure, detect and classify objects [43].

Also, AI can make autonomous vehicles safer by being able to navigate complex scenarios and traffic. Automated Guided Vehicle technology helps reduce operating costs and achieve optimal productivity in a warehouse.

3.3 Cloud Computing

The postal and logistics sector, in the face of a large-scale data set, so can no longer meet the massive and multi-source access and processing of heterogeneous data. With the development of cloud computing, big data, and the Internet of Things, this work is easier [44]. Cloud computing is a model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can be rapidly provisioned and released with minimal management effort or service provider interaction [45]. This cloud model is composed of five essential characteristics, three service models, and four deployment models. Essential characteristics are [45]: On-demand self-service; Broad network access; Resource pooling; Rapid elasticity; Measured service. Service models are [45]: Software as a Service (SaaS); Platform as a Service (PaaS); Infrastructure as a Service (IaaS).

Cloud computing services provide essential benefits for individuals and organizations, but some challenges negatively impact public confidence regarding their adoption and use. The public confidence challenges foster doubt and uncertainty regarding the safety, privacy and loss of control of data in the cloud computing environment [46].

4 Barriers to implementation

In the papers [47]-[49] following risks for the implementation of previously mentioned technologies were identified: (Cyber) security, privacy, and trust, high investment and setup costs, lack of technical skills and standardization, lack of infrastructure, as well as the digital transformation of the legacy system, the absence of competence in IT security, workers' fear of losing their jobs, negative effects on the workers' motivation, and resistance to change.

Some of the challenges that will increasingly impact the future application of digital strategies include [17]:

1. Trust/cyber security - The importance of digital trust is manifold. That is the belief that customers' private information is protected.
2. Digital identity - It allows individuals to prove who they are. It enables customers for accessing benefits and services via digital platforms. This move toward Digital Identity platforms can increase the efficiency of service delivery, reduce transaction costs, and increases transparency.
3. Big Data - This enables the use of Big Data techniques for capacity building, creating digital awareness, and delivering technical assistance.
4. Digital ecosystem - This is a platform enabling digital economy including digital postal and logistics development. It comprises companies, people, data, processes, and IoT that are connected by shared use of digital platforms.

5 Conclusion

Researches on the application of new technologies in the postal and logistics industry are still insufficient. The researches are mostly theoretical with insufficient examples and analyses from practice. The existing literature mainly talks about the advantages and

possibilities of applying the mentioned technologies. The goal of all mentioned technologies is to improve business, increase efficiency and security, more efficiently monitor and reduce costs and risks. The next step for all the mentioned and other modern technologies, and in general, towards the digitalization of postal and logistics processes is their wider adoption. Although often expensive, digitization provides significant benefits to every sector that realizes it. Digitalization is expected to help create new, alternative sources of employment which are more relevant to emerging times and relearning new skills.

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