

A SYSTEMATIC REVIEW ON FLEXIBILITY ENABLERS IN LOGISTICS SURVIVABILITY

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Abstract. The demand uncertainty particularly during the outbreak of COVID-19 and the increasing competition of market have imposed pressures on the logistics industry to embrace the technology innovation. The pandemic caused a huge impact on world economies and communities and many companies were struggling to survive in this changing environment, thus leaving a question to the resilience of industry. In this situation, flexibility plays the key role for the logistics industry to recover from the supply chain crisis and get prepared for future uncertainties. This paper aims to provide a comprehensive insight on the technology innovations which enable the function of flexibility in logistics through a systematic literature analysis of papers from 2017 to 2022. Bibliometric analysis and content analysis are the methods used to analyse the multiple sources from different databases. The main research gaps in this paper is the flexibility enablers available in the logistics field, their implications on the logistics operations in terms of survivability performance are analysed and the challenges for the adoption of these flexibility enablers to the logistics service providers (LSPs) are identified. The identified flexibility enablers are blockchain, automated guided vehicle (AGV), drones, big data, radio frequency identification (RFID), cyber-physical system (CPS), sensors, cloud computing, augmented reality (AR), unmanned aerial vehicle (UAV), internet of things (IoT), digital twin, artificial Intelligence (AI) and information and communications technology (ICT). An implication model is set up to show the relationship of these flexibility with the logistics. The barriers to the LSPs to adopt the flexibility enablers are categorised into economic barriers, managerial barriers and operational barriers. Overall, these could provide some suggestions to the LSPs when they are considering the technological transformation and assist technology developers in identifying commercial opportunities.

Keywords: *flexibility, technologies, adoption, logistics management, supply chain, logistics service providers*

Introduction

Logistics survivability are the knowledge and skills that allow a company to utilize its performance development for a long term through logistics activities such as supply chain, inventory management, material handling and transportation. According to Ivanov and Dolgui (2020), it is the highest level of analysis for SC responses to disturbances that supply chain survival is examined. In order for logistics companies to be sustainable and resilient, they must also be capable of resisting disaster (Ivanov and Dolgui, 2020). Plus, survivability is defined as the extent to which organizations can continue to provide goods and services even after disasters due to global pandemics recently have occurred (Mogili et al., 2020). Perhaps, a flexibility enabler that affects logistics survivability may provide gain for a long-term development in competitive advantages company performance. Flexibility enablers are qualified to meet the logistics demand from time to time. After searching at the flexibility enablers in every category, it was decided that the flexibility enablers for "how" could be split into two smaller groups which is one group would include enablers that focus on attitude and the

other would focus more on organization (Sohi et al., 2020). With flexibility, a business is able to embrace change and smooth delivery to meet the specific needs of its customers. This is because developing countries require flexibility in all aspects of logistics operations, from the point of origin to the point of consumption, so survivability in logistics depends on flexibility.

To address this logistics survivability, a lack of flexibility in the supply chain caused a few disruptions such as unseen fragilities that imposed a strong disruptive force on logistics and supply chain. They must be highly agile and nimble by emphasising on adaptivity to unanticipated disruptions and developing new logistics sustainable strategies and models. As we can see in previous situations for example, the pandemic revealed the new challenges posed by modern industry that the players in the global supply chain should gather with. To relate with this, due to industry 4.0, every company should play a role to adapt technology in logistics operations. Organisations were encouraged to adopt the advanced technologies to achieve the purpose of sustainability as it offered the opportunities for improving the economic efficiency, environmental performance, and social impact of logistics sectors (Sun et al., 2022). Other than that, the logistics sector has a slower pace of digitization compared to other sectors. To retain the competitive advantages in long term development, logistics companies must gain these capabilities in this era of globalization in order to create flexibility.

The study aimed at the flexibility enablers for logistics survivability. In order to guide the analysis, the following research objectives are then developed based on: (RO 1) to determine the types of flexibility enablers available for logistics survivability; (RO 2) to analyse the implications of adoption of flexibility enablers for logistics survivability; and (RO 3) to identify the challenges to logistics service providers to adopt flexibility enablers for logistics survivability.

Literature review

In this part we highlight on survivability, factors to improve survivability of logistics, criteria to determine logistics performance, logistics service provider, flexibility in logistics and logistics technology trend that affected our study research. In terms of our study on survivability, the firm's survival is the ultimate measure for its performance and one of the most often used metrics of corporate performance is the length of survival (Li et al., 2020). Regarding to improve this survivability, sustainable logistics refers to the practices and processes aimed at improving the sustainability of supply-chain activities, ranging from the supply of raw materials to the transformation processes, the storage, the packaging, the distribution and the management of the end of the lifecycle of products (Testi, 2020). So, sustainability in logistics can be seen as a practice or performance in supply chain management (Kumar, 2022). The result of the studies mentioned above showed similarity in which the brand value corresponds with the market pressures, misuse of resources with organizational resources, government intervention and international regulations with regulatory pressures. It follows by criteria to determine logistics performance based on the logistics performance is determined by the timely delivery of products to the receiver while maintaining the quality and competence of the logistics services (Gözaçan and Lafci, 2020). Plus, research from Panayides and So (2005) states that LSPs play an important role in the supply chain as they have a great influence on the performance and effectiveness of the supply chain. In terms of flexibility in logistics, there are three types which are supply chain flexibility, distribution flexibility and demand management flexibility. According

Manders et al. (2017), it's possible that the study of flexibility aspects will be drastically altered if they look at it from a supply chain perspective. For the purpose of gaining insights concerning flexibility dimensions that are applicable to the entire supply chain, additional in-depth research is required. Relating flexibility strategies (supply flexibility, distribution/logistics flexibility and manufacturing flexibility) that aid in the mitigation of risk associated with respective components of the supply chain (Sreedevi and Saranga, 2017). Due to industry 4.0, businesses have found new ways to improve their sustainable logistics management, the operational transformation that comes with implementing these new technologies has never been easy and may face structural resistance both within and between businesses (Sony and Naik, 2019).

Materials and Methods

This study is conducted as a systematic literature review (SLR) which is a method of qualitative research. SLR collects, selects, and critically analyzes data from the published literature on a specific issue or phenomena to answer the research questions. The unit of analysis of this study is journal articles. The bibliometric and content analysis are applied to conduct the study. The bibliometric analysis helps to quantify published journal papers by mathematical and statistical evaluation while the content analysis is a research method for determining the existence of specific words, topics, or concepts in qualitative data. The data collection undergoes three steps: literature search, paper selection and review process. In the first step, the inclusion and exclusion criteria are set up. The search string: “Flexibility” OR “Flexible” OR “Quick response” AND “Technologies” OR “Digital” OR “Logistics 4.0” AND “Logistics” is used to collect the related articles. The sources for the research are from peer-reviewed journal articles to ensure the quality of research. The time range set for the journal articles are during the time period of 2017-2022. The journal articles in English published are focused on this research. The data are collected from journal articles of several databases which are Scopus, ScienceDirect and EmeraldInsight. The access to these databases is provided by Library eResources of UUM which an online platform is offering a wide range of electronic resources.

The screening process was carried out in step one and two by reviewing the articles. The researchers used a website called “Covidence” to ease the process of screening. From 168 articles in the first step, the articles were filtered and snowballing was applied as a technique to obtain additional information based on the references of selected papers. Finally, there was a corpus of 32 articles selected and content analysis was carried out on these articles by using the software, NVIVO 11, in the review process. The figure below shows the PRISMA flow diagram of the screening process of papers (*Figure 1*).



Figure 1. PRISMA flow diagram shows the screening process of papers.

Results and Discussion

Bibliometric analysis

Bibliometric analysis was introduced as a mathematical and statistical approach for academic literature (Evangelista et al., 2018). It analyses the information of a research field from multiple databases and quantitatively summarises the information to give insights into research topic trends, the number of publications and its trend, the most productive scholars, institutions, or countries, and the journals in which these articles are frequently published. Because only the papers collected may be regarded as the discipline's foundations, bibliometric analysis focuses on publications that have received a lot of citations from other authors throughout time (Wang et al., 2017). As a result, bibliometric analysis can produce results that are more thorough and objective than the usual author-scoped literature evaluations. The trend of distributions from 2017-2022 is clearly shown in *Figure 2* with a geometric growth pattern that shows increasing interest of researchers. The number of articles produced in 2021 records the highest. The 32 papers are obtained from 22 different journals and the Transportation Research Part E: Logistics and Transportation Review is the most cited journal with 5 articles followed by the International Journal of Production Research with 4 (*Table 1*). Moreover, 2 papers are cited respectively from Logistics, Journal of Business Research and International Journal of Logistics Management. The rest of the papers are from different journals with 1 article for each. Lastly, the *Figure 3* shows the word cloud which illustrates the frequent words appearing in all the articles.

Table 1. Cited journals in the research.

Journal	Total of papers
Transportation Research Part E: Logistics and Transportation Review	5

International Journal of Production Research	4
Logistics	2
Journal of Business Research	2
International Journal of Logistics Management	2
Energies	1
International Journal of Information Management	1
Journal of Computational Science	1
Sensors	1
Technology in Society	1
Transportation Research Interdisciplinary Perspectives	1
Sustainability (Switzerland)	1
The International Journal of Advanced Manufacturing Technology	1
International Journal of Logistics Research and Applications	1
Sustainable Cities and Society	1
Environmental Science and Pollution Research	1
International Journal of Production Economics	1
Cleaner Logistics and Supply Chain	1
The Electronic Journal of Information Systems in Developing Countries	1
Journal of Global Operations and Strategic Sourcing	1
Knowledge Management Research & Practice	1
Communications of the Association for Information Systems	1
Total	32

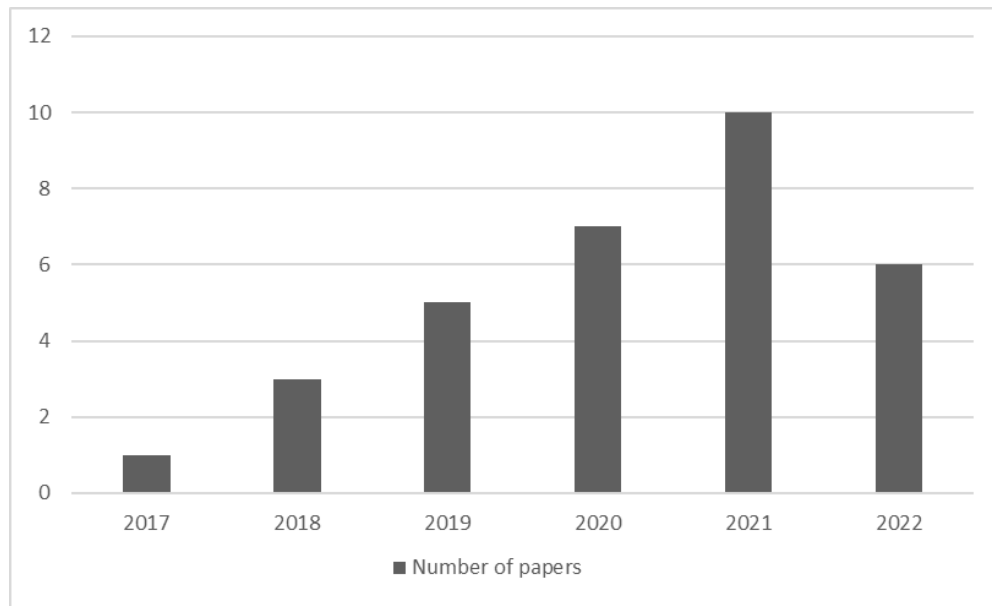


Figure 2. Records of distributions over the years.

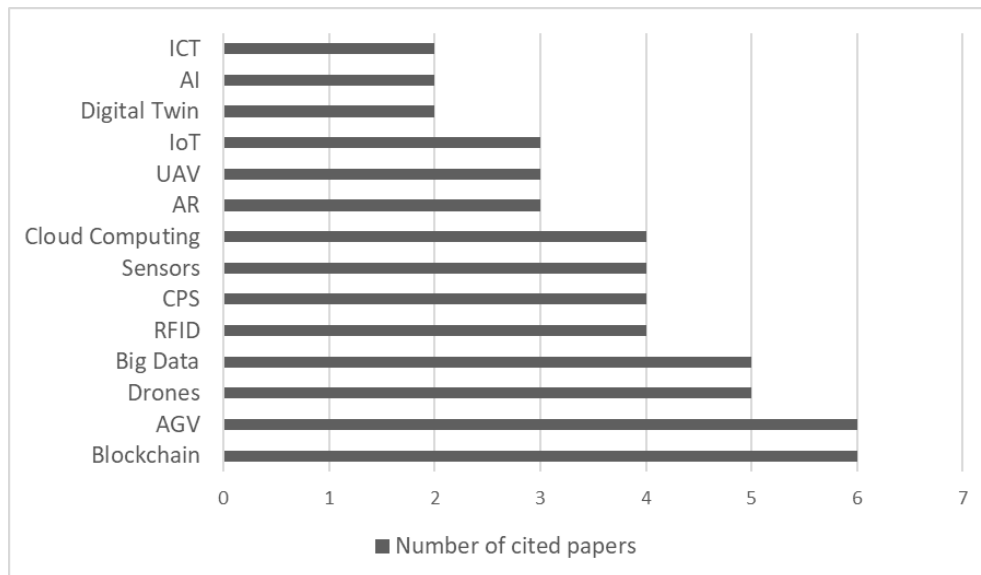


Figure 4. Technologies that are recognised with function to enhance flexibility of logistics and their sources.

Another flexibility enablers are AGV, another most cited number of sources, and followed by drones. AGV and drones play an important role in monitoring (Khatib and Barco, 2021), controlling, and tracking the logistics activities such as movement of goods, logistics resources and inventory management (Zafarzadeh et al., 2021). They ensure whether the operation is responding to in a quick manner. They can help the system perform flexibility fast and safer by adapting its behaviour to the timeliest changes (Steclik et al., 2022; Cichosz et al., 2020; Tang and Veelenturf, 2019). Sharing real-time data and enabling device-to-device communication has facilitated their responsive performance by reprogramming in the shortest time to change their tasks or the path of operation (Custodio and Machado, 2019), which lowers operating expenses and lowers the labour force requirements while enhancing the performance of businesses in the industry (Rey et al., 2021). Big data works like blockchain as a tool for data analysis (Zafarzadeh et al., 2021) that enhances the flexibility of the distribution process (Khatib and Barco, 2021). It is important for discovering consumer needs, purchasing patterns, market trends, potential risks, equipment maintenance, delivery reliability and responsiveness, and technical problems with the logistics system (Sun et al., 2022). With this analysis, the logistics firm can design a sustainable ship routing and scheduling (Chalmeta and Santos-deLeón, 2020) to keep up with real-time changes. For instance, the flow trucks at the port in Singapore are managed by the Flow-Through Gate system that is supported by big data technology to process a massive amount of data for trucks' movement and drivers' information.

Other than that, RFID, sensors, CPS, and cloud computing are cited by 4 sources. RFID and sensors enable flexibility (Chung, 2021; Zafarzadeh et al., 2021) and efficiency both the short and long terms through tracking capabilities (Lagorio et al., 2020). Massive amounts of data are collected using sensors to track products, or to monitor machines, processes, and environmental conditions (Khatib and Barco, 2021). Higher levels of depth in the information available on the processes are made possible by these deployments. They are used for managing terminal/distribution centre operations/ports, warehousing, and transportation (Chung, 2021; Khatib and Barco, 2021; Custodio and Machado, 2019). RFID is used frequently in warehouses to provide

real-time data of the flow of goods' arrival and departure thus forming a reliable database to show the inventory level (Zafarzadeh et al., 2021; Custodio and Machado, 2019). This eliminates the need for manual stock taking regularly which is time-consuming. The flexibility of warehouses is improved by real-time synchronization of physical goods and information then contributes to lower risk of costs incurred by late deliveries, such as lost sales costs, out of stock costs, and penalties imposed by customers. Other than warehouses, RFID also is used for transportation as well as sensors. RFID is applied by the port authorities to keep track of all container movements in real time, verifying for expected deliveries and determining which infrastructure and processes are necessary for managing correct routes (D'Amico et al., 2021). Therefore, data mining enables the path of the load to be optimised reducing processing times. For road transport, sensors are embedded on carriers to keep an eye on environmental factors like temperature and acceleration (Zafarzadeh et al., 2021). This allows better control by having adequate information which helps to ensure the quality of goods and lower risks from possibility of goods spoilage during transportation. The cost of transportation can be lowered and the delivery of goods of poor quality to customers is avoided (Custodio and Machado, 2019). Other than on carriers, they are installed on roads and bridges to monitor and analyse traffic congestion in real-time (D'Amico et al., 2021).

Furthermore, cyber-physical system (CPS) and cloud computing are critical tools for responsiveness (Custodio and Machado, 2019) by providing real-time data to ensure doing the right decision at the right time when the changes are taking place for logistics processes (Stączek et al., 2021). CPS could facilitate a high response rate for material flow which is changing with demand (Zafarzadeh et al., 2021). CPS provides autonomous and adaptable automation systems such as distributed robotics (Custodio and Machado, 2019). By integrating with sensors, CPS-based smart production logistics systems receive the data of the movement of load carriers and changes of resources in real-time thus performing self-organisation. The system leads to high flexibility and efficiency through reducing the buffer level and enabling dynamic scheduling (Zafarzadeh et al., 2021; Winkelhaus and Grosse, 2019). Same as CPS, cloud computing plays the function of managing data and allows control, track and trace-related activities (Zafarzadeh et al., 2021). It provides a platform for decentralised access to various data analyses and centralised storage of that data (Sun et al., 2022). This supports the exchange of information of entire supply chains globally which enables flexibility to customers and market changes. Subsequently, it lowers expenses by outsourcing and maximising resources (Khatib and Barco, 2021).

Next, IoT, UAV and AR are cited by 3 sources respectively. IoT has the same function as CPS and cloud computing that act as a flexible system (Custodio and Machado, 2019) to ensure the right decision-making in a quick response (Stączek et al., 2021). IoT is a computing tool to link the internet in order to share the information to different processes and actors during the logistics operation such as operators, automated equipment. When everything is connected online, completely new opportunities for intelligence and adaptability development open up by taking the role as a predictive analytics tool for the operation of warehouse, distribution and transportation (Rey et al., 2021). It enhances the inventory management by tracking capabilities which enable better planning for re-stocking and distribution activities. The beneficial activities include calculating the quickest delivery routes, seeing indicators of inadequate equipment, or reminding personnel to update equipment components. While

for the transportation, it is applied to update the real-time information of vehicles on the status, location and estimated-time delivery which could prevent time losses due to traffic or mitigate theft cases.

An unmanned aerial vehicle (UAV) is responsive for on-time deliveries and low-carbon delivery services, which serve to better safeguard both the driver and the clients by reducing interaction (Sun et al., 2022; Chen et al., 2021). UAS is a system of combination of UAV with sensors and Bluetooth which provide real-time information on material and equipment condition and quality (Sellevold et al., 2020). It can decrease last-mile delivery costs and shipping times effectively. Moreover, AR performs a digital support for controlling which is significant to data analytics that facilitates reconfigurability of supply chain and lead to flexible capacity, backup-transportation routes, resource preservation, multiple sourcing, product substitution and risk mitigation inventory (Dolgui and Ivanov, 2021). It provides real-time video with computer generated images (Khatib and Barco, 2021) to better control inventory and warehouse management to do quality inspection particularly warehouses with high-rack storage (Zafarzadeh et al., 2021). It allows better speed to react to changes to avoid and mitigate failure investigation. The speed of packaging and palletizing is improved with the assistance of AR. It also makes the scheduling and routing of vehicles to be data-driven with intelligent fleet management (Dolgui and Ivanov, 2021).

Additionally, there are 2 sources that state that digital twin, AI and ICT are enablers for logistics flexibility. Digital twin is a virtual representation of the real world that tells the lifecycle of a process, product, or service by using real-time data, machine learning, and reasoning. It monitors and tracks a system changes overtime with the virtual presentation and produces estimations for historical and present and future states in the form of statistics and calculates KPIs (Stączek et al., 2021). This could enhance the efficiency of machines, robots, conveyors, vehicles, and other devices by observing, mapping and analyzing details, and sending commands on time to improve the logistics operation performance and get shorter on time delivery (Abideen et al, 2021). Next, AI acts as a data analysis tool like big data and blockchain to evaluate historical and real-time data to enable responsive logistics services (Jamkhaneh et al., 2022; Zafarzadeh et al., 2021). It is one of the important elements for order tracking systems to ensure cheaper and faster delivery services through dynamic planning of routes and resources (Sun et al., 2022). Lastly, ICT is recognised with capability in improving flexibility (Khatib and Barco, 2021) through its traceability, intelligent systems, data analytics, optimization, simulation, and integration platforms (Giusti et al., 2019). It is an intelligent and integrated system to provide a bridge for the physical and digital worlds and connect different stakeholders who are involved in the logistics process such as warehouse operators, drivers, and customers. It is also linked with other technologies like sensors and IoT to provide a comprehensive database to aid in data-driven decision-making. Through incorporating these technologies, it performs many functions such as allows the stakeholders to track the goods along the movement. The data collected are used to predict the trends, costs and service levels thus optimizing the resources and simulating scenarios as a support for decision making.

The implication model

A model is developed to illustrate the influence of the technologies that enable flexibility in maintaining the logistics performance for better survivability (*Figure 5*). To improve the responsiveness of logistics, it requires the collaboration of multiple

technologies to perform a comprehensive system that is facilitated by mutual aid on each other. Therefore, after reviewing multiple articles related to the flexibility enablers, their implications are summed up into three aspects which are requirements for logistics flexibility, effects of flexibility on logistics and benefits on logistics from flexibility.

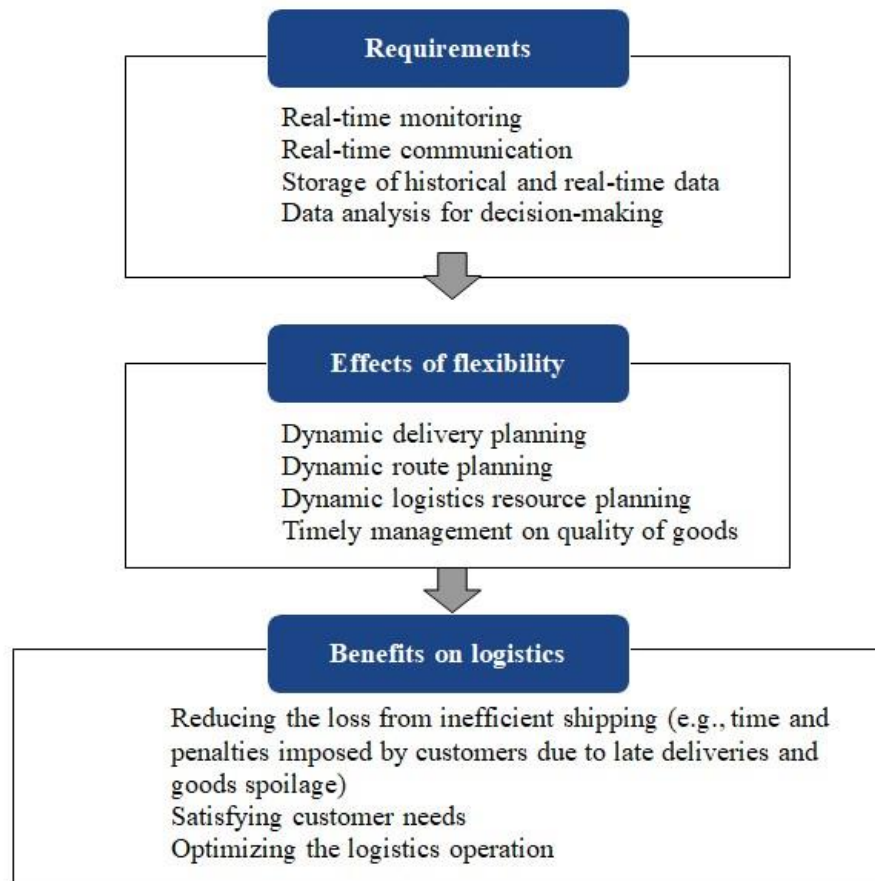


Figure 5. The implication model of flexibility enablers to logistics operation.

Firstly, real-time visibility is the critical key to improve responsiveness. Monitoring and tracking tools like drones, sensors, AR and RFID are implemented to observe the logistics activities from time to time (Khatib and Barco, 2021; Zafarzadeh et al., 2021; Custodio and Machado, 2019). Once there are signs that activities are out of track, the operators can be informed at the moment and react to the situation with the right solutions. To support this quick transfer of information to the personnel, real-time communication is needed to connect the stakeholders for a better horizontal logistics collaboration. The enablers for this process are CPS, IoT, and ICT (Sun et al., 2022; Rey et al., 2021; Giusti et al., 2019) which help a lot in ensuring the system and the process will be more well-controlled and allow the synchronisation of the seamless flow of physical goods and associated information along the chain.

When real-time communication is achieved, the logistics operators are required to decide on the right action to take in order to mitigate the loss and maintain the profitability of business. A data-driven decision will be more reliable as the decision must be made timely in a quick manner. In this case, the operators rely on data analytics tools such as blockchain, big data, digital twin and AI (Stączek et al., 2021; Zafarzadeh et al., 2021) that collect and store massive historical and real-time data. For instance,

digital twins can predict the historical and present and future states in the form of statistics and calculate KPIs. With the assistance from these flexibility enablers, they are able to identify the best solution for logistics machinery based on the data available. The effects of the integration of the aforementioned flexibility enablers encompass dynamic delivery planning, route planning, logistics resource planning and timely management of quality of goods. These are also supported by automotive flexibility enablers such as AGV (Custodio and Machado, 2019) that can reprogram in the shortest time to change their tasks or the path of operation based on the different situation while UAV (Sellevold et al., 2020) can provide information on material and equipment condition and quality on time with embedded sensors. They facilitate quick responses in an unmanned manner which can significantly reduce human errors and increase task accuracy.

With high flexibility effects on logistics contributed by the flexibility enablers, the logistics operation can benefit from effective reduction of the loss from inefficient shipping. Inefficient shipping will cause time loss and penalties imposed by customers due to late deliveries and goods spoilage (Zafarzadeh et al., 2021). Good management of goods and service quality with on time required actions are key elements to increase the level of customer satisfaction and thus leading to good reputation of companies (Lagorio et al., 2020). The logistics resources also are optimised in a well-organised way as a random decision-making may cause wastes and loss to the companies. The risks such as demand volatility are able to be managed and under control (Kouhizadeh et al., 2021).

Challenges to logistics service providers (LSP) for adoption

Implementing technological advancements affect an LSP (Cichosz et al., 2020). In the logistics technology transformation that is occurring to associated processes with the requirements of the development in Industry 4.0. Numerous technologies have been implemented and developed. To remain competitive and expand, LSPs must enhance their added value for shippers and clients. This significantly increases operating effectiveness by addressing industry issues such as low transparency, inefficient assets, high fragmentation, expensive manual progress until end consumption. There are some factors that are challenges to LSP implementing.

Economic barriers

Companies operating in nations with unstable governments face additional risks of the amount of profits they can raise. Some governments impose numerous regulations on foreign firms, which can severely limit the strategic decisions a company must make to profit. This can be related with technology issues, impose what percentage of joint ventures local partners must own and place restrictions on the long-term gain of profits. High technology implementation and maintaining costs occurs according to economic barriers. According (Alalawneh and Alkhatib, 2020), rapid growth of the emergence of technological innovation in big data (BD) had barriers in developing the economy. This is because cost, financial resources and return on investment was the adoption progress in applying technology for logistics service providers (LSP). Perhaps, the declining cost of resources in technology was expensive (Sivarajah et al., 2017). This implementation of technology in LSP must be required in investing some money on IT infrastructure, human skills in these fields, business experts and analytical instruments. Thus, the low

sufficient in finance income or finance preparedness to help the cost of technology and implementation can show in certain failures which may be affected in implementing digitization on LSP. In addition, regarding high costs and financial resources it can measure and justify investment as a constraint of implementing technology in LSP. This *Figure 6* of this process highlights the barriers of management among implementing the technology. Necessary changes at the organisational level and the process management. The figure shows data life cycle 3 categories of data, process and management challenges: (1) data challenges (relate to the characteristics of technology (BD) itself); (2) process challenges (relate on how during the technology (BD) transfer); and (3) management challenges (relate on how understanding and analysing technology).

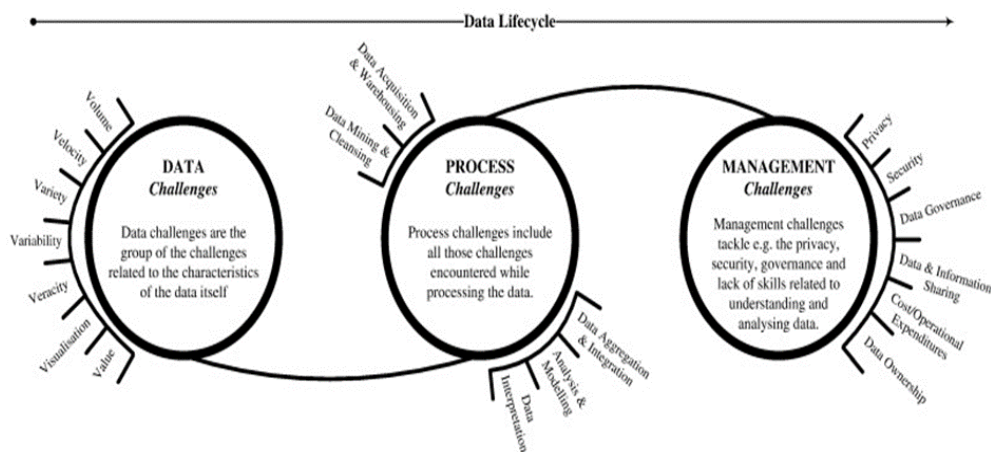


Figure 6. Classification of technology challenges.
Sources: Sivarajah et al. (2017).

Managerial characteristics that influence the adoption of technology including attitudes of top management, organizational culture and organizational policy constraints. Proper management culture can support implementing technology and reduce the risk with advancement technology implementing. Top management obstacles, such as a lack of top management commitment and support are important barriers to the adoption of IT innovation (Lamba and Singh, 2018). Management can inspire and enable workforce to use technology applications by setting up reward systems and tying them to technology use (Watson, 2019). The point of policies is to make sure that employees know what the organisation thinks and values about certain things, like implementing technology in LSP. So, privacy, ownership, security and data governance are all organisational policy barriers. Lack of policies meant to facilitate new adoptions, to coordinate and harmonise regulations on a national and continental level, and to define standards. Management sceptical of the business value of advanced digital technologies.

Operational barriers

Operations are more efficient by fixing problems in the industry like customer connectors, low transparency, high fragmentation, underutilised assets, expensive manual processes, and in many cases. With LSPs management, cross-functional teams continue pursuing alignment with their members in order to operate within consumer alternatives based on digital innovations (Cichosz et al., 2020). This is because success factors are related with how well operations and progress organisations work.

Operations are very crucial parts to deal with LSP to sustain the logistics systems and process. No matter how digitally matured a company is, our analysis showed that simplification and standardisation are important. In addition, operations are more efficient and responsive, improve the customer experience, and add new services or even business model platforms that are new and different. They keep pointing out benefits to the environment that would not be conceivable without technological solutions.

In addition, according (Karia, 2018), in the age of technology and knowledge, LSPs need to keep human intelligence (which can't be copied or replaced) at work as the most important resource for long-term strategic advantages. Regarding this outcome, lack of resources required for their implementation in operation gives negative impact due to industry 4.0. An example that we can see is blockchain is a type of internet technology that makes it possible to send money and other valuables over the internet in a safe way without the help of a financial institution (Asokan et al., 2022). On the other hand, IoT-based huge aeroplanes (LSPs) in the whole supply chain will be a big step toward more people using these technologies. As we can see it gives a huge impact on operational performance in terms of lack of specialists with skills. Plus, the most important thing preventing digital transformation (DT) is a lack of digital world, followed by a lack of action and support of top management and a lack of initiative to take risks. This information can help LSPs who want digital transformation take the right steps to ease. This is because immature digital culture happens among the operation and organisation progress.

Conclusion

In conclusion, this research also can help a company or decision-maker come up with rules or programs that show the organization's willingness to change and adapt in the future performance. This outcome of study shows that flexibility enablers and their implications include blockchain, automated guided vehicle (AGV), drones, big data, radio frequency identification (RFID), cyber-physical system (CPS), sensors, cloud computing, augmented reality (AR), unmanned aerial vehicle (UAV), internet of things (IoT), digital twin, artificial Intelligence (AI) and information and communications technology (ICT). It reflects on how these technologies affect the logistics activities. Plus, in terms of implementing this technology, there are challenges in logistics service providers adoption such as economic barriers, managerial barriers and operational barriers. Furthermore, our distribution on this research includes a theoretical contribution that can identify the adoption regarding technologies that facilitate flexibility by integrating the literature in the logistics and supply chain management fields. Plus, practical contribution reflects on giving LSPs a picture to discover the technologies that are most likely to improve their operations and assisting technology developers in identifying commercial opportunities.

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Conflict of interest

The authors declare no conflict of interest with any parties involved with this research study.

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