A Study on Application of Automation Technology in Logistics and Its Effect on E-Commerce

Brilian P. Amiruddin
Electrical Engineering Department
Institut Teknologi Sepuluh Nopember
Surabaya, East Java, Indonesia 60111
brilianamiruddin.17071@mhs.its.ac.id

Denisse R. Romdhony
Electrical Engineering Department
Institut Teknologi Sepuluh Nopember
Surabaya, East Java, Indonesia 60111
denisse.17071@mhs.its.ac.id

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Abstract

Since the world transformed into the digital era, e-commerce is the real thing to concern for everyone, not only limited to the business people but also for people who want to buy something without hassle. Furthermore, as an estimation global retail e-commerce sales almost grow doubled in range of three years from US$ 1.3 trillion in 2014 to US$ 2.3 trillion in 2017 and this growth trend will still last until the future. However, this trend demands innovative solutions, applying automation technology to e-commerce logistics is one of the solutions which significant to the future of e-commerce. Based on that, this study principally talks about the real-world implementation example of automation technology in logistics as well discuss the effects that will be faced by e-commerce towards using the automation technology in logistics so the e-commerce industry will be ready for facing future disruption.

1 Introduction

E-Commerce (Electronic-Commerce), a modern business technology, firstly implemented in the 1960s by the company named CompuServe [1], developed constantly until it began popular in the past three decades marked by the establishment of Amazon.com, eBay, and Alibaba. In the 2010s, many e-commerce services emerged operated in the two different major types of business models. They are business to consumer (B2C) and business to business (B2B) [2] consist of online transportation, online food ordering, online marketplace, online accommodation booking, and e-commerce payment systems. Nowadays, e-commerce has been a part of our life. Using the internet, All transactions have been brought to the electronically way from the phase of choosing what we want to buy until the payment methods itself. Due to e-commerce conveniences and modest model, people widely used e-commerce to fulfil daily needs, making both the number of users and delivery demand increases dramatically every year.

Based on the scope for the role of logistics requirement growth much larger [3], e-commerce needs to adopt technologies that allowing them to handle Logistics and Supply Chain Management (LSCM) moreover ensure the interchange of packets from the packing process to the hand of consumers in order to raise consumer satisfaction. The recent development of e-commerce also contributed to the expansion of the logistics market, promote the development of technologies related to logistics [4]. So far, these advancements are already implemented in most company that relied on the delivery process:

- Automated data collection systems
- Inventory management systems
- EDI (Electronic Data Interchange)

As a brief, automated data collection systems are a system based on a computer application that facilities the process of data collection allowed specific structured information to be gathered using installed QR Code and Barcode scanner.

Every recorded sensor readings stored in the private local server forming inventory management systems that can monitor the flow package inbound and outbound every single data of package are recorded to the system named EDI (Electronic Data Interchange) then EDI will upload all gathered data to the opened-access server so every consumer can track current status and location of their parcel.

Nevertheless, with the logistics and supply chain sector advancement, consumers still put complaints responding to poor delivery services. Some great companies such as DHL still facing this problem. Eager to improve their services, companies open up customer service line for the consumer to deliver consumer feedbacks :

- Lateness caused by shipping delay
- Mismatch addresses
- Incorrect tracking information
- Broken package due to bad handling

According to the list [5], most of those complaints are caused by low-skilled and culture of the worker [6]. Besides that, there are many factors including the worker's awareness, either because of emotions, fatigue, healthiness, or skills. Thus, e-commerce needs a robust system that can manage those problems which are called automation. Automation is a system that provides automatic control for operating logistics equipment which performed with minimal human assistance. Furthermore in this study, we provided novel insights about the application of automation in logistics and its implementation effect on e-commerce.

2 Methods

We had conducted this study by two steps, the literature review and a qualitative content analysis research method. In the beginning, on the literature review, the scientific literature from the internet was searched and gathered, the scientific literature would be used as material arguments in this paper, and we searched it from trusted sources. We were used trusted and authentic journals search engines sites such as Google Scholars, ScienceDirect and IEEEXplore to get the relevant scientific literature for the research subject that as well from trusted publishers. For instance, we were searched through literature to get the concrete definition of automation and e-commerce. The last step, after we got the conceptual foundation from the literature review about the research topic, we started the next step which was a qualitative content analysis research method, from the definition of qualitative content analysis is a technique for studying the meaning that was included in the body of a statement.

It was accomplished by categorizing and organizing the content of a communication systematically into categories which interpret the topics, themes, and context of that message. Although it was most frequently applied to text, the qualitative content analysis could be used to any textual media, verbal or visual [7], on this occasion, people opinions or textual data about the research topic was gathered and obtained by we from reliable websites like Forbes, industrial insights such as logistics industry insights from DHL, and the other sources. After getting the data needed, then we searched the correlation and connection between the data and found the findings according to the study conducted that was the application of automation technology to logistics and its effect on e-commerce.

3 Results and Discussion

After analyzing and finding a correlation between the data from the content sources, we got the results found. First, automation technology had much application in logistics. Some forms of automation technology applications in the logistics were Warehouse Control Systems, Industrial Robotics, and Automated Storage [8]. In details, Warehouse Control Systems (WCS) is systems in software interface format which are used in the logistics warehouse to manages and controls the warehouse equipment, WCS gave focus on controlling machines, from the controlled machines the data of machine and work process would be gathered, comparison of the functional features from various WCS systems can be seen in Figure 1. In the future development, WCS was upgraded to newer sophisticated technology called Smart WCS which offer a better solution to conventional WCS drawback, with Smart WCS we could get a variety of expandability, function and strong data collection capability [9]. Next, the industrial robotics, the definition of industrial robotics is an automatic position-controlled reprogrammable multifunctional manipulator having several axes capable of handling materials, parts, tools or specialized devices through variable programmed operations for the performance of a variety of tasks [10], so in case of application in logistics, the industrial robotics would have programmed operations which focused on what logistics need.

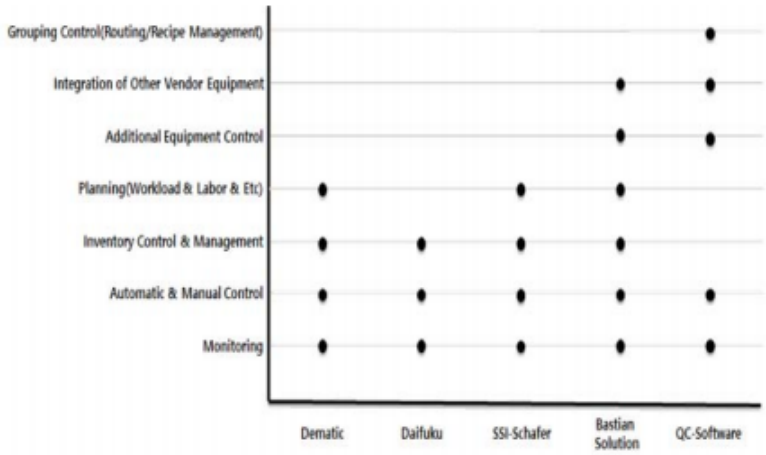

Figure 1: WCS Functional Features [9]

The real-world examples to industrial robotics in logistics were trailer and container loading robots, stationary piece picking robots, mobile piece picking robots, co-packing and customization, and home delivery robots [11], moreover, all this sort of industrial robots instance were based on Autonomous Mobile Robots (AMR), Automated Guided Vehicles (AGV) and Unmanned Aerial Vehicles (UAV) type, AMR and AGV had similarities, both were operated on-ground, but AMR more sophisticated in terms of technology, compared to AGV it was worked in the less constrained world, so its utility and mobility enhanced [12], whereas UAV type was operated on-air, UAV would automatically pick up allocated shipments from the conveyor belt and take off, in case of return to the hub UAV could carry out point to point deliveries which lay on the routes [13], Figure 2 shows UAV (DHL Paketcopter) is delivering goods.

Figure 2: DHL Paketcopter Delivering Packet [13]

Then, automated storage or widely called as AS/RS systems (Automated Storage and Retrieval Systems) considered being an essential part of logistics [14], AS/RS was an integrated automated system comprised of software, hardware, and networking system communicating with each other over fieldbus network [15], components of AS/RS were including racks for storage places, cranes for material handling, the empty spaces between racks called aisles, I/O and pick positions, AS/RS as well communicates to other warehouse modules, such as conveyor, so its performance influenced the whole warehouse performance [16].

Second, the effect for the e-commerce of the automation technology application into the logistics was the e-commerce could get many advantages which it never had before, e-commerce shipping and returns would be faster and flexible with the implementation of automation, mainly because of the industrial robotics UAV and UMR, these robots could help e-commerce to deliver or return the package for customer in the same day or even minutes [17], not only faster and flexible delivery or returns but with robotics, the cost of delivery which charged to the e-commerce customer was also significantly reduced, for an illustration with robots the e-commerce customer was charged only $0.05 per miles conversely with premium ground services like UPS or FedEx it would be charged around $6 or $6.5 [18], the application of automation as well made lower e-commerce customer complaints about misdelivery due to mislabelling the package, in contrast with human more likely encounter error issues so the chance of misdelivery would be increased

and customer complaints soared [19], e-commerce productivity and efficiency also improved with the presence of automation in logistics, the automated machine could work doing the same task 24 hours a day without mistakes from emotional aspects, but humans could not [20], in some cases, the customer ordered goods in midnight but due to the human workforce were resting the order could not be processed on the same time after a customer ordered, but with automation, it could be processed immediately, not merely because of the emotional aspect, the labor price also would be decreased with the application of automation due to eliminated number of costs associated to insurance, vacation time, and labor accidents [21].

Even though the application of automation had many advantages, it also had some barriers and downsides in the implementation. The automated delivering robots had some issues according to the regulation, safety, and security, the regulatory approval in a developed country such as the United Kingdom was more straightforward as the government had future thinking about drone deliveries [22], a contrast to developing country like Indonesia the delivering robots could not be applied because of Indonesia did not have regulations for commercial use of drone robots [23], not only regulation but safety and security also the barrier, anyone did not want drone robots to fall from the sky due to mechanical faults or cunning hacker, so the safety reasons for people, property, animals, and their packages also being concerned [22], for the security matters the delivery robots could easily be hacked to steal their goods, from the expensive device itself, or even encourage illegal market activities [24]. The high cost toward applying automation at the initial year was also the issue that brings many businesses to turn down their desire to invest in this technology although the following year the cost would highly be reduced, as an example at the first year of investment the application would cost around $432,000 for the automation systems and $70,000 for operator costs, the next year it would only take $70,000 for operator costs without costs on automation systems again [25].

The study results confirm automation technology had many applications on the logistics industry, for instance, the Warehouse Control Systems (WCS), Automated Storage, then Industrial Robotics including Automated Guided Vehicle, Autonomous Mobile Robots, and Unmanned Aerial Vehicle. This study also provides novel insight into the relationship between automation technology application on logistics and the e-commerce, the use of automation could bring advantages to e-commerce itself, but it also had some obstacle on the implementation. The advantages of automation implementation were making packages delivery also return faster and more flexible, reducing delivery costs, decreasing the misdelivery and mislabelling of the package, increasing e-commerce productivity and efficiency. Nevertheless, the application of automation technology also had some obstacle such the safety, security, and regulation for pertaining this technology was not ready in some country, as well the costs for applying the technology at the first time is very substantial, so many businesses did not want to upgrade their tech.

4 Conclusion

We have presented the results of the conducted study on the application of automation technology into logistics and its effect on e-commerce, we have concluded automation has many apps on the logistics industry which could affect the e-commerce with pros and cons effects also barrier on the implementation. To sum up, we have provided novel insights for logistics and e-commerce industry according to the study topics, so from the insights we provided, we wish it will be useful for the e-commerce industry consideration of upgrading their technology in future.

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