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Outcomes of intelligent logistics in retail organizations

How Intelligent Logistics affects the retail organizations

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Outcomes of intelligent logistics in retail organizations: How Intelligent Logistics affects the retail organizations

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ABSTRACT (MAX. 200 WORDS):
The efficiency of retail organizations has been improved with the help of internet technology, using big data, cloud computing, and other technologies to upgrade the supply chain, marketing, and logistics of goods and other models. Among these areas, intelligent logistics has played a significant role in the development of retail organizations. This article studies the benefits and challenges of the transformation of logistics to intelligent logistics and the role it is playing in retail organizations with the help of a depth literature study and conducting interviews, and making analysis afterward. The article also analyses the current situation of the use of intelligent logistics in retail enterprises and provides some suggestions.

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1 Introduction

The first chapter of this thesis provides some background and contextual information of our topic of research followed by highlighting the research gap in that area, describing research questions with intended research purpose and in the last some delimitations about this study.

1.1 Background

The retail sector constitutes a significant part of the global economy with a global market sale of nearly 25 trillion US dollars with an estimate to reach close to 27 trillion US dollars in the year 2022 (Statista, 2021a). Just like for other industries, logistics operations play a strategic role for retail organizations (Ltifi & Gharbi, 2015). This is because logistics nowadays is not only limited to operational efficiency, but it is also a strategic variable for value creation (Gil-Saura et al., 2010). For modern retailers, the role of logistics in their corporate strategy is paired with creating profitability and supporting market expansion (Abrahamsson & Rehme, 2010). By combining these two strategies, these modern retailers are adding new business at marginal cost. It also helps them to keep their operational resources aligned with their corporate strategies (Abrahamsson & Rehme, 2010).

Over the years, logistics has evolved from traditional transportation system to strategic, cross functional and global discipline (Grant et al, 2006). Logistic industry is the backbone of the global economy as right from the dawn of industrial revolutions, there was an increased demand of transportation of manufactured goods (Statista, 2019) with a global logistic market size of about 5.5 trillion EUR recorded in 2018 (Statista, 2021b). The fourth industrial revolutions widely known as Industry 4.0 has a great impact in creating value in logistics from design through production (Hydro et al., 2013; Hofmann & Rüsch, 2017). Industry 4.0 and logistic 4.0 or intelligent logistics are highly interconnected terms with a common trend of digitalization, virtualization and networking of data and information (Gilstau & Machado, 2018). In logistics, the new trend of intelligent logistics is the concept of industry 4.0, summarized as optimization of inbound and outbound logistics that have got support different technologies and embedded software's to achieve a certain degree of automation (Rajkumar et el, 2010). This system helps to decrease the element of inaccurate estimates in logistic tasks and provide real time access to valuable information as well as to make processes faster. In each step, human involvement is always needed to control the processes and systems in case of any failure (Barreto et al., 2017).

According to Gregor, Krajcovic and Weicek in 2017, it is estimated that by the year 2030, half of the European factories will be operating its own internal logistics with the use of autonomous mobile robotics systems (MRS). In 2021, there are already more than 35 billion devices connected via IoT and by 2025, the forecast suggests that there will be more than 75 billion IoT devices in use which is a nearly threefold increase as compared to IoT devices in 2019 (statista 2016). This shows the general increase in the trend of usage of intelligent logistics. Retailers need to revisit their logistics strategies and remain agile in a competitive business environment (Anon, 2021).

Like other sectors, the retail organization also continued to expand their investments in technologies and ICT as they realized the significance of technology acceptance and their role in achieving higher productivity and growth (Priporas et al., 2017). In order to survive in todays

globalized environment, organization need to constantly revive their business process and incorporate the dynamic demands of market (Nagy et al., 2018).

1.2 Research problem

The retail sector is undergoing remarkable transformation with technology driven innovations ranging from one-click order placement to more personalized recommendation and anticipatory shipping of products e.g., amazon has replaced many brick and mortar retailers with online retailers that are empowered with AI technologies (Nicholas and Megan, 2018).The current covid-19 pandemic and lock down regulations have further instigated new challenges and opportunities for retail organization, employees as well as consumers which led to path for adaptation of e-services, home deliveries and store-pickups (Willems et al, 2021). In these prevailing circumstances, there can increased interest of industries as well as researchers to realize the opportunities provided by these technologies advancement and to gain full benefits out of it. But still it is just the beginning, and a lot is yet to be explored.

In order to understand the concept of intelligent logistics, different scholars have come forward with different prospect and definitions of intelligent logistics. Some of them are discussed in detail in chapter 2 but a common definition of intelligent logistics could be the use of intelligent technologies that are the centre of fourth industrial revolution, to improve the automation level of logistic system (Winkelhaus & Grosse, 2020). This industrial revolution has been given various names such as intelligent logistics, smarts logistics and logistics 4.0. Although the fourth industrial revolutions came with its challenges for the current logistics, at the same time provided convenience with its disruptive technologies to revise business models (Evangelista et al., 2018). The transformation from logistics to intelligent logistics is not as simple in retail organizations as it sounds. Fernie and Sparks, authors of logistics and retail management, describe the need for retail organisations to improve logistics by considering of a number of factors such as storage facilities, inventory, transport, communication and so on (Fernie & Sparks, 2018). Thus, retail groups that need to transform their logistics has many aspects to consider.

However, there is a keen interest developed within logistic researchers for intelligent logistics and supply chain but still there is a lot of potential for future research in this field as there are many important questions which are left unanswered. This is because most of the research focuses mainly on the technologies used while other focus on the key drivers of this shift instead of intelligent logistics role in context of business perspective (Ghadge et al., 2020; Jain and Ajmera, 2020; Veile et al., 2020) As intelligent logistics is still an emerging concept, researchers can still investigate this field in many prospects. There is very little already done so far specially in relation with the role of intelligent logistics in retail sector.

At present, many large retail organizations already have begun to practice intelligent logistics, and government has also given policy support in the development of intelligent logistics (Rowe et al., 1996). As change is the only constant, business landscape is constantly changing and consequently so does the needs of every business to embrace those changes smartly. Hence, there is a constant need to reshape business strategies and to keep pace with the technological advances to survive in the business landscape (Wang et al., 2019). Therefore, this master thesis can prove helpful to provide some insight about the current standing of intelligent logistics and its significance in retail sector and can help researchers to lead towards some exciting future endeavours.

1.3 Research questions

According to the gap of the effect of the application of intelligent logistics in retail organizations, the purpose of this thesis is to discover the role of the emerging concept of intelligent logistics and the benefits and challenges of this technological paradigm shift for retail organisations. This aim is also in line with our research question, which is as follows.

- What is the outcome of intelligent logistics in retail organizations?

1.4 Research purpose

The purpose of this research is to scrutinize the current state of logistics in terms of its advancement and intelligence and to explore the benefits of the newly emerging concept of intelligent logistics in creating benefit for businesses especially in relation to the retail companies. As for retail sector, it is highly crucial to improve the performance and efficiency of its business to keep its survival possible in market, which seems impossible without keeping pace with the emerging advances in technology so therefore, with the help of our research question, we aim to find out the current benefits and challenges of intelligent logistics in retail organizations. This will provide some experiences for retail organisations that are already using intelligent logistics, and some examples for those that are ready to use it.

1.5 Delimitation

This thesis explores the benefits and challenges of intelligent logistics for retail organisations from the perspective of information system. For the selection of retail organisations, the authors chose to interview large scale organizations that have successfully implemented intelligent logistics. We selected large retail organisations because they have more complex situations so that we can draw more conclusions. Also, the result of this thesis is confined to the role of intelligent logistics in retail companies only. Due to the time limit and pandemic, the expressiveness of online interviews has made the information extraction limited to some extent. So therefore, not every aspect of the retail organization is explored fully in this thesis. Therefore, this thesis focuses on the innovative technologies of intelligent logistics in retail companies, their benefits as well as their possible challenges that arise in the journey to embrace this technological shift. The results of this thesis cannot be replicated to any context other than the retail companies.

2 Theoretical Background

This section provides a thorough literature review for our area of research that mainly consist of two parts: One is the intelligent logistics and other is the retail organizations. The section opens by throwing some light on the history of logistics, its development over the period and the evolution of intelligent logistics along with its associated technologies and digital transformations. Other section provides historical background of retail organizations along with the significance of logistics activities in retail organization, highlighting the current needs of logistics in retail sector and the applications of logistics for retail organization therefore, providing a detailed insight of how intelligent logistics came over and changed the way business used to function in the retail sector, the challenges and benefits that intelligent logistics brings in retail organizations. The chapter is concluded with a derived theoretcial framework resulting from the literature review performed for this research, which proves the basis for our empirical findings and consequently facilitates in answering our research question.

2.1 Overview of intelligent logistics

2.1.1 Logistics

Despite there have been various definitions offered for logistics due to the disagreements among general business, practitioners, and operations professionals. These definitions may vary from industry to industry, however in the business context, they are revised over the time with respect to the changes in business landscape (Lummus et al, 2001). Logistics constitutes in adding "place utility" to a product where the buyer and seller of the product have agreed to sell and purchase product at certain terms and conditions that involve delivery place and time (Islam et al., 2013). The classic logistics solutions were intended to strive for deterministic time series of orders and deliveries and improving the ability to plan and forecast (Bowersox & Closs,1996).

The linguistic root of the word "Logistics" originated from the French word "logis" which means accommodation of troops (Ballou, 2006). Before 1950, logistics was thought as military term with the procurement, transportation and maintenance of military facilities, goods and personnel's rather than the current business logistic concept (Lummus et al., 2001; Islam, Meier, Aditjandra, Zunder & Pace, 2013; Ballou, 2006). It was in 1954 that logistic was first introduced in terms of business context and was called business logistics (Amr et al., 2019). In the business context, logistics is the successful handling of the effective and efficient flow of goods and services from the point of its origin to the company and then from the company to the customers with the intention of fulfilling their needs (Lummus et al, 2001). This process includes the planning phase, the implementation phase and the careful monitoring and control of the entire life cycle. This definition includes inbound, outbound, internal and external movements and return of material for environmental purposes (Lummus, et al, 2001).

While exploring the history of logistics, one of the earliest definitions of logistics is the science of the efficient movement of material flows (Meidutė, 2005). Heskett et al in 1964 described business logistics as the physical supply and distribution of goods that takes place throughout the supply channel. However, D.J Bowersox in 1986 extended this definition as the logical and successful succession of storage and supplies that is initiated from the raw material source to the manufacturing process and supply channel, finally ending with the consumer (Bowersox, 1986). While in Scandinavia, the classical concept of logistics involves the interrelationship of the modelling, organization, coordination, management and controlling of all the activities that include the movement of materials that is from raw materials to manufacturing and then to the end consumer (Johannessen & Solem, 2002; Solem, 2003). The goal of logistic involves great planning and calculations to minimize both the overstocking or shortage of equipment (Luttwalk, 1971). Therefore, its performance constitutes two main dimensions "Logistic Quality" and "Logistic Cost" (Dehler, 2001; Kotzab, 1997). Logistic quality refers to meeting the customer demands by delivering the right product to the right destination at the right time and in the right quality and the logistic cost is the cost incurred in transportation, inventory, and the overall cost of having assets (Mollenkopf et al.,2000).

There is still a confusion about how logistics differs from the recently used term of supply chain management as both fields overlap. Both logistics and broader supply chain management mainly intend to help business function effectively by making the goods available when and where needed with right quantities (Archetti & Speranza, 2016). Literature shows that logistics seems to be more tactical and operational while supply chain management is more strategic in nature (Lummus et al, 2001). Logistics and supply chain both play a vital role in any organization from a business aspect and to the overall industry as well (Amr et al., 2019). Although the significance of supply chain management has grown in importance since the mid-1990s, the definition of logistic management and SCM has become more or less interchangeable in the council of logistic management (Abrahamsson & Rehme, 2010).

2.1.2 Transformation of logistics to intelligent logistics

Back in the 1960 and 1970s, logistics was concerned only with optimization of "3Ps": Place, Period and Pace & Pattern, focusing on the optimization of transportation and moving of goods physically (Ballou, 2006). Logistics at that time was the beginning of the mass transportation era (Wang, 2016). During the 1960s, the significance of mass production was realized which required the automation of cargo handling, the invention of electric power led to this second innovation on logistics (Amr et al., 2019; Wang, 2016). The focus was shifted from physical flow of goods to increase the level of optimization within the process and the coordination between different parties belonging to the same chain (Amr et al ,2019). The third revolution in logistics came with the invention of computers and IT technology leading to the systemization of logistics management in the 1980s (Wang, 2016). This era focuses on the flow management at all levels of organization making it an evolution rather than revolution (Amr et al., 2019). Today with the evolution of IoS and Big Data, it is seen that the logistics services sector will greatly reduce the human intervention in each step consequently with the overall cost reduction of 34.2% and overall increase in additional revenue by 33.6% (Lehmacher et al, 2017; Wang 2016). Today, the logistic operations are not only confined to in-plant supply processes but they also include the material handling operations in warehouses (Hydro et al., 2013). The increased complexities of manufacturing warehouses have resulted in increased complexity of component portfolio ultimately leading towards complex ware-

housing process. Hence nowadays, the demand for real-time data and increased contextual information of these complex warehouses are improved through intelligent technologies in logistics (Trappey et al., 2017). Although in literature, the term intelligent has appeared very often with logistics; there is no unanimously acceptable definition for the notion of intelligent logistics (Mcfarlane et al., 2017). In most literature, the word intelligent logistics is often used to refer to the planning, execution, monitoring, and control of logistics operations (inventory, transport and order management) in a more intelligent way compared to conventional solutions. The level of intelligence may vary among different applications and methods like product tracking and environmental sensing, problem recognition and automatic decision making and execution (Mcfarlane et al, 2016). Intelligent logistics must be able to should maximum profit to the supplier and at the same time must provide the best service to the consumer (Mcfarlane et al., 2017) with the goal of consuming the least amount of natural and social resources. Therefore, protecting the ecological environment to the maximum extent and forming a complete intelligent social logistics management system (Hutchison & Mitchell, 2008). At present intelligent logistics systems uses different technologies like infrared, laser, wireless, coding, address recognition, automatic identification, positioning, contactless power supply, fibre optics, databases, sensors, RFID, satellite positioning and other high technology (Grzybowska et al., 2020). The characteristics of intelligent logistics include Adaptability, changeability flexibility, self-organization and intelligent decision making etc. Other key tasks of intelligent logistics are to continuously reduce logistics cost and pressure on resources and environment by means of technology and to improve logistic efficiency and flexibility (Li et al., 2018). Intelligent logistic systems also assists to save cost subsequently making a positive influence on customer satisfaction and customer retention (Schramm-Klein & Morschett, 2006). Intelligent logistics has gained more and more attention over the years in research where intelligent logistics have been published in journals with different scope such as operation management, information or logistics showing interdisciplinary character of intelligent logistics (Winkelhaus & Grosse, 2020).

While scrutinizing the journey of logistics, over the years, till its evolution to intelligent logistics, it can be seen that logistics has evolved from traditional transportation systems to strategic, cross functional and global discipline (Grant et al, 2006). The table 2.1 below provides a compact summarization of evolution of logistics in different Era's. The future planning of logistics is critical to any organization and its significance can be predicted from the impact of logistics on increased success of a company. It was therefore concluded by researcher Gracht and Darkow in 2013 in their research on the future role of logistics for global wealth based on the global logistics scenarios 2025 that the future of logistics can play a significant role to build triple bottom line that is profit, people and planet (von der Gracht & Darkow, 2013).

Table 2.1: Evolution of logistics adapted from Szymańska et al., 2017

	Period	Description
Era 1 (Farm to market)	1916-1940	transport and distribution of main interest, base: transporting products to points of sales, large influence of economics on logistics,
Era 2 (Segmented Functions)	1940-1960	distinguishing independent functions: warehousing, inventory management, sales and transport (coming in and out) increase in the physical distribution efficiency.
Era 3	1960-1970	integration of functional areas,

(Integrated Functions)		implementation of the term "total costs" to business practice, system approach, distribution as a process from the reception of ready-made products from an assembly line to their delivery to the final user,
Era 4 (Customer Focus)	1970-1985	customer-focused, customer service perceived as a physical distribution element, logistics popularity increase in sciences, interest in inventory productivity and inventory balancing costs,
Era 5 (Logistics as a Differentiator)	1985-1997 (publication data)	logistics as a key factor in the enterprise differentiation strategy and in obtaining a competitive advantage and value added, integrated supply chain management, influence of it technologies, logistics perceived as a sequence of business processes,
Era 6 (Behavioural and Boundary Spanning)	Future (with respect to the article publication date)	interest in customer behaviour and integrated supply chain management, logistic customer service as a priority, cooperation between enterprises that perform logistic functions.

2.1.3 Emerging technologies in intelligent logistics

Over the past few decades, logistics technology is growing expeditiously from manual operations to mechanizations and from mechanization to automation (Wu & Ge, 2019). Recent innovation in technology and automotive are rapidly changing the way logistic task activities were managed previously (Speranza, 2018) Technologies like big data, cloud computing, machine learning, Artificial Intelligence and internet of things (IoT) have been introduced in logistics equipment industry. With the rapid increase in logistics volume, the manual handling, sorting, distribution and storage of inventory goods can no longer satisfy the growing logistics industry demands (Wu & Ge, 2019). New technologies are making the internal logistics more adaptive, requiring changes in the overall future solutions (Hübner et al., 2016; Vavrík et al., 2017). Some of the technologies related to intelligent logistics are also discussed in the literature review of this thesis to gain some insight of what benefits they are providing towards business growth and efficiency.

- IoT

According to Winkelhaus and Grosse in 2020, IoT is the main application of intelligent logistics according to existing literature on intelligent logistics, as 45% articles mentioned IoT which was also deeply connected to the radio frequency identification devices (RFID) (Bag et al., 2020). IoT operates by integrating various devices equipped with sensors, networks, processors and other communication technologies (Xu et al., 2014). Many researches indicates that IoT will play a significant role in the future of logistic industry (Atzori et al., 2010; Hopkins & Hawking, 2018; Malik et al., 2017; Xu et al., 2014). According to Gupta et al in 2020, IoT helps to empower logistic planning and transparency in whole transportation process. Lit-

erature also shows the potential benefits of IoT realized in logistics including automated information flow, enhanced cooperation between partners, enhanced internal processes and real-time responsiveness (Atzori et al., 2010; Friedewald & Raabe, 2011; Winkelhaus & Grosse, 2020). It can be observed that IoT have undergone massive growth and popularity in the previous years and now even smaller companies are able to partially innovate in IoT (Gregor et al., 2017)

- Big data

In terms of intelligent logistics, big data plays an important role in improving management activities, decision-making, forecasting and transparency (Winkelhaus & Grosse, 2020). Big data was originally defined as three Vs: Variety (diversity in terms of data), Volume (Large amount of data) and Velocity (high speed data generation) that requires flexible architecture for efficient storage, manipulation and analysis of data (Grewal et al., 2018; Mcafee & Brynjolfsson, 2012; Sandeep et al., 2021; Winkelhaus & Grosse, 2020). An additional characteristic of value, validity, veracity and visibility have also been proposed to define big data (Marr, 2015; Wamba et al., 2015). With the help of big data, businesses can collect and use versatile data sets related to various business process and activities for timely, fast and effective decision making (Ghosh, 2016). Literature indicates that big data technology is competent of handling information centrally via cloud computing and decentral via autonomous systems (Winkelhaus & Grosse, 2020). According to an estimate 25 quintillion of data is created every day, the real challenge for organization is less about how to collect information but how to manage this vast quantity of information and extract meaningful information from it (Bakshi, 2012). Another research indicates that to improve the standard of logistic services, big data analytics can be used as the basic approach. It is therefore recognized that big data can immensely add value and bring monetary gain for firms (Raman et al., 2018; Wang et al., 2016). Investigating the adoption of big data in logistics by using TOE and innovation diffusion theory, Lai, Sun and Ren in 2018 conducted a survey that shows that top management support, perceived benefits, environmental impact and government policies influence the big data analytics (BDA) adoption in organizations (Lai et al., 2018)

- Cloud computing

Another technology to satisfy the current demands of intelligent logistics service is cloud computing. Cloud computing facilitates to build, collect, store and handle multi-source heterogeneous data from sensors, RFID tags and applications (Yang et al., 2017). Cloud computing is the model for enabling on demand network access to a shared pool of configurable computing resources that can be dynamically provisioned and released with minimal management effort (NIST, 2011). The network data usage can enable advance form of predictive analytics for organization which seems impossible with traditionally deployed solutions as they are relevant to individual companies (Levans, 2017). Literature indicates that cloud computing helps with a more service-oriented architecture thus enabling flexibility due to dynamic resource provision to handle huge amounts of data produced by IoT which is crucial to business decisions and for information management in distributed systems (Kong et al., 2015; Qu et al., 2016).

- AGV

Another equipment of intelligent logistics is automated guided vehicle AGV designed mainly for material handling, assembly, distribution and other production processes (Li et al., 2018).

Equipped with an automatic steering, these robots are capable of guiding along a predetermined path of travel (Qi et al., 2015). AGV has become an inevitable choice for intelligent logistics from the process of handling raw material in line to warehousing transportation (Li et al., 2018). Organizations are using AGV robots to minimise the cost of human operators in logistics as well as to achieve remarkable tasks and minimize the human errors (Jaiganesh et al., 2014). AGV is one of the key equipment in inducing automations in logistics and with the rapid development of intelligent logistics, the scope of AGV is also expanding (Li et al., 2018; Liu et al., 2021).

- Smart warehouse

Smart warehouse is the automation of various components of warehouse with the help of interconnected technologies (Lowe, 2021). Smart warehouse automation has also emerged as an efficient and competitive solution for suppliers and distributors (Ries et al., 2017). It helps to enable cost effective, end to end warehouse service for efficient storage and retrieval of product and reduce chances of human error and delays in warehouse (Culler & Long, 2016). With the help of smart warehouse automation, a variety of customer oriented services can be performed (He et al., 2018).

- Artificial intelligence (AI)

Artificial intelligence refers to a program, machine and system that induces intelligence in any product, service or solution (Shankar, 2018). AI is also a rapidly evolving technology in the logistic sector to gain reliability, integrity and efficiency (Foster & Rhoden, 2020). Research indicates that all kinds of stakeholders, whether they are authorities, shippers or carriers, are interested in AI technologies (Dong et al., 2021; He et al., 2014; Wu et al., 2018).

- Block chain

Technologies like blockchain also offers great solution by securing the entire supply chain from raw material to end customer. It significantly helps to meet customer expectation and reduce operational cost but there is a general lack of literature of blockchain with respect to its role in intelligent logistics (Crainic et al., 2018; Foster & Rhoden, 2020). Therefore, there is still no answer in research about how to incorporate blockchain in real logistics systems to make it fruitful (Crainic et al., 2018; Perboli et al., 2018) but in industrial practice, the benefits of Blockchain is far more realized than what the research has explored so far (Winnesota, 2021). Considering the fact that this technology has been already very matured in the industry, there are a great surge of researches which are required already (Dong et al., 2021). The limited literature so far has revealed various interesting applications of block chain including track and trace, increased visibility in transportation and credit evaluation (Chowdhury et al., 2017; Wu et al., 2017).

- Drones or Stacker cranes

The use of stacker cranes is also common in automatic warehouses. The stacker cranes come with certain limitations of handling one product in one row which is now overcome by introducing another device called shuttle and drones (Cho, 2018). However, little literature has been found for stacker crane and most of the articles focus mainly on different types of strategies to support technologies implementations. (Dong et al., 2021), Electric vehicle, stacker cranes and drones are closely related with one another (Müller et al., 2019) and are playing

significant role in retail to improve efficiency and cut down labour cost by replacing manual handling with new technologies.

Concluding the above discussed technologies, below is the graph that shows some of the most game changer technologies for the logistic industry in 2018, exhibiting the practical aspect of the usage of these technologies in logistic industry.

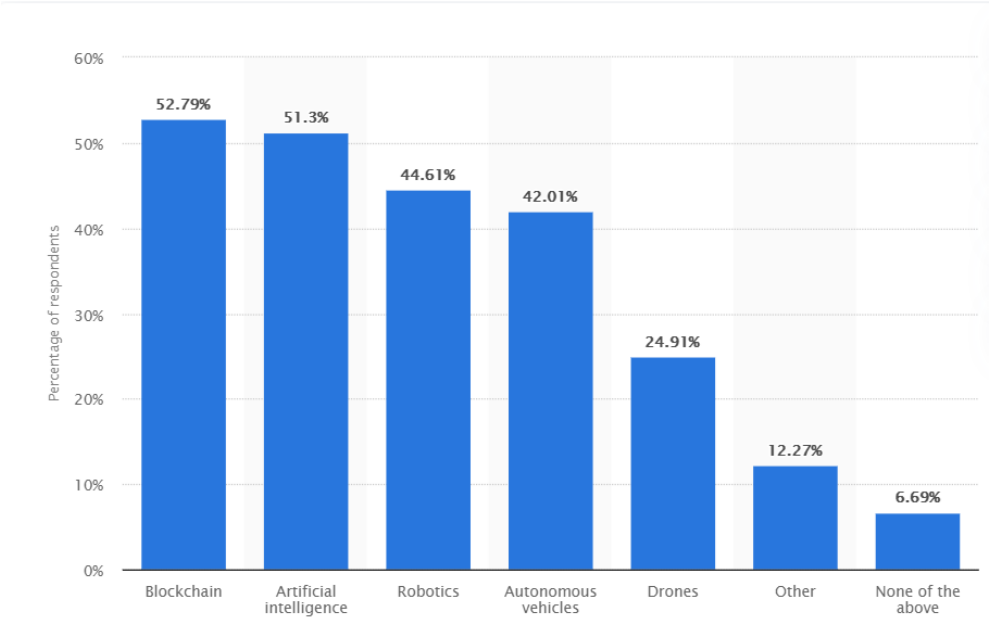

Figure 2.1 Graph taken from Statista, 2019b: Which technologies are game-changing for the logistic industry right now.

According to figure 2.1, the most significant intelligent logistic technologies in industry in 2019 was block chain technology with 52.79% followed by Artificial Intelligence with little variation of 51.3%. After that, comes the technology of robotics 44.6 %, autonomous vehicles 42.01% and drones 24.91% which are quite similar in terms of their usage. This shows that the technologies most talked about in literature like IoT and cloud computing are not mentioned explicitly in real industry among the one creating significance in logistics.

2.2 Historical development of retail organization

2.2.1 Retail organizations

The retail sector has undergone various transitions over the years (Wacker et al., 2018). This is because of the digital transformation of the business landscape inducing significant change in the way business used to function. The intense use of ICT has caused change in all the business processes and consequently in the customer behaviour as well, making the retail sector an even more dynamic sector (Priporas et al., 2017). Over the last fifty years, this rate of changes has increased dramatically (Hopping, 2000).

The history of retail is similar to the history of technology in society. When we look at the history of retail industry, it seems that technology was the biggest game changer (Hopping, 2000). The retailers in term of definition are the intermediaries that facilitates suppliers to find goods market to sell their products to customers according to their desire and needs (Niemeier & Naylor, 2012). Steadily with time and with the help of new management skills and emerging technologies, the retailers turned out to be more skilful and more powerful. The history of retail is classified mainly into three eras: The mercantile era, the modern era and the digital era. Traditionally trade was carried out through suppliers bringing their goods to the market but their demand for storage of goods started to increase with their specialization in production (O'Sullivan, 2012). It was the time when merchants used to finance their operations and their freighting activities on their own but the first wave increased the scale and scope of trade through internationalization (Niemeier & Naylor, 2012). Ultimately sea routes in 16th century made it possible for merchants to reach globe. The modern era for retail organization began in 1760s when the technology progression paved its wave for mass productions resulting in increased production of goods consequently leading towards increased affordability of goods. This era proved significant for its advancement in self-service supermarkets, hypermarkets and vertical retail. The departmental stores became highly popular due to their retail strategies of fixed prices, return policies and newspaper advertisement (Niemeier & Naylor, 2012). Then comes the third era that started with digitalization in the 1990s, previously retailers followed just physical market but now with the help of technological innovations and advent of internet online shopping experience paved its way. The establishment of amazon in 1994 and eBay in 1995 marked the beginning of digitalization. The vertical retail model with the internet gave rise to a new style of retailing (Niemeier & Naylor, 2012).

However, this history of retail has received the most popularity among the areas of historians and marketing (Jones, 2010). But despite of all these advancements and paradigm shifts, retail industry remains highly vulnerable to business failures (McGurr & DeVaney, 1998). In today's world, technology can be a threat to retailers if they seem resistant to embrace it as retail will continue to get more and more complicated in future (Hopping, 2000). Also, nowadays there is an increasing overlap of online and brick & mortar retailing due to the emergence of strong online channels, resulting in a major transformation in retail logistics over the last decade (Hübner et al., 2016). But to implement it in the most fruitful way is still a challenge rather to decide whether to implement it or not (Gallino & Moreno, 2014). Literature on retail indicates that it is not only the technological aspects that matters, like every other organization, culture also plays a critical role for retail organization in technology adoption and organizational growth and subsequently determining the success and failure of organizational level (Qazi et al., 2017). According to a study conducted on 436 employees organized through a randomly questionnaire method, it was concluded that the retail sector is experiencing a moderate level of organizational culture and job satisfaction which can be improved further (Qazi et al., 2017).

2.2.2 Significance of logistics in retail organization

It is irrefutable that logistics play a key success role for the retailers (Schramm-Klein & Morschett, 2006). Along with marketing, the role of logistics is fundamental to create differentiation and competitiveness in retail supply chains (Lorentz & Lounela, 2011). The strategic value of logistics can be seen from several best practice examples of companies like Dell, H&M, Zara and Hewlett Packard where the strategic excellence played a vital role in the overall success of these companies (Sandberg et al., 2011). To better understand the concept

of strategic value of logistics in retail business, let's explore the background of this concept a little bit further. Traditionally logistics was considered as an operational entity only rather than something that can provide incentive to corporate strategy (Sandberg et al., 2011). Instead of using logistics operations to improve the overall company performance in terms of profitability and market growth, logistics scholars stayed inside the logistics box by developing logistic strategies in isolation with relation to overall business growth (Schramm-Klein & Morschett, 2006). This trend render less fruitful results in consequences with the need to shift this trend and include the logistics planning in the strategic planning of business. According to another research by Forslund and Jonsson in 2007. Nowadays, the logistics performance management consists of a sequential process which includes selecting metrics, defining metrics, setting targets and then measuring and analysing them, this comes under company strategic planning (Lohman et al., 2004). Complementary to this, there should be a general agreement between all the stakeholders involved in terms of which logistic performance to apply (Forslund & Jonsson, 2010). Some of the logistics metrics that are significant in food suppliers and retailers includes defect free product delivery, efficient handling of returns, complete orders, effective handling of returns and emergency order and efficient handling of information about shortage of orders (Theodoras et al., 2005). Whereas out of stock is assumed as critical logistic metrics (Lorentz & Lounela, 2011). Another development in the supply chain in retail is the acknowledgement of sustainable metrics which constitutes in reduced packaging, alternatives of fuels and carbon footprints Wiese et al. (2012). Logistic activities of modern retailers are often associated with much of environmental cost where most of these retailers have developed or are in process of developing environmental strategies. Most of the time it is to demonstrate the investors and other stakeholders the corporate social responsibility but as consumers are becoming more and more environmentally conscious, now the retailers have also become much more genuinely committed towards sustainability both in environmental and social terms (Mckinnon & Edward, 2018). However, there is very less focus found in the studies of logistics performance in retail organization which indicates a research gap that the scholars can focus on in future (Wiese et al., 2011).

Other role of logistics in retail organization includes securing profitability from economy of scale and to scale up the delivery system to high dynamics of effectiveness as well as to create cost-effective logistic set-up (Young, 2008). This can be achieved by constantly redefining the internal logistics activities including coherence between the entire business function of retail shops. Only in this way can the maximum economy of scale be achieved (Fligstein et al., 1990).

2.3 Roles of intelligent logistics in retail organization

2.3.1 Current changes in logistics practices

According to Abrahamsson et al. in 2003, the more any business is dynamic with quick changes in demand, the more important it is to ensure a cost effective, flexible and adaptive logistic platform. The accelerated advancement of digitalization and innovative technologies, has triggered dynamicity in the retail industry (Wacker et al., 2018). Nowadays, the concept of “new retail” is gaining strength. This concept was emerged by Jack Ma, the founder of e-

commerce giant Alibaba in 2016, according to him, “new retail” is a business model that blends both digital and offline experience (GMA, 2021). This “new retail” relies primarily on Omni-channel logistics based on integrated supply chains, order-driven precise logistics services and high-intensity urban distribution carrying capacity consequently resulting in significant opportunities in the logistic industry (Zheng et al., 2019). The adaptation towards new retail requires transformation and innovation in logistics business model. With this upgradation trend of logistic industry, emerges the concept of intelligent logistics (Tang & Yang, 2018). The new retail concept puts new requirement towards logistic industry to support retail enterprises (Zheng et al., 2019) that demands high integration of online data, offline entities and a good integration of Omni-channel logistics to improve efficiency in business flow and a better customer experience (Shen, 2017).

With the pandemic of Covid-19 in 2019, the current demand for logistics in retail organizations has taken a dramatic turn. The result of lockdowns has forced many brick & mortar retailers to close physical stores and move more rapidly towards technological solutions e.g., online ordering, click and collect and robot assisted operations (Shankar et al., 2021). The customer behaviour is changing rapidly with the changing business landscape and technological innovations where now mobile phones have become new retail showrooms and the millennial generation is experiencing an even more customized digital shopping experience (Demirkan & Spohrer, 2014). These new opportunities have led businesses to progress with the emerging technologies and many organizations have already chosen to provide self-service system options to their customers and employees for a better, efficient and customized service experience (Bitner et al., 2002). In relation to retail organization, these self-service systems for online shopping are among the fastest growing applications in 21 centuries (Castro et al., 2012).

From the literature, it can be deduced that the current demand of retail is highly tied up with the customer loyalty and satisfaction. If the customer expectations are not met they may choose to switch to another store or retailer competitor (Bouzaabia et al., 2013). Ltifi and Garbi in 2015 in their empirical study concluded that internal logistics performance in a retail business positively influences customer satisfaction and profitability (Ltifi & Gharbi, 2015). According to Winkelhaus and Grosse in 2020, the customer’s demand for highly customized products became an external trigger for the paradigmatic change of the fourth industrial revolution leading towards intelligent logistics. This has also induced change in the society as whole by changing the way how daily operations are performed (Lasi et al., 2014). Davis-Sramek, Mentzer and stank in their research on customer loyalty and durability in 2018, figured out that logistics influence customer service as it is the main driver of price, quality, variety and delivery speed. Hence, logistics plays a character both in marketing and production (Kent and Flint 1997). With reference to the marketing side of logistic, Porter's value chain in 1985 also indicates dependency of marketing and logistics in creating value for organizations where marketing focus on demand creation and logistics focus on satisfying customer needs through optimal fulfilment of transportation of physical goods (Mollenkopf et al., 2000). Literature reveals that a positive relationship of logistics with intra-organizational communication can result in improving overall performance of retail companies (Schramm-Klein, 2003; Lings, 2000).

Another important factor influencing the current changes in logistic practices is the increasing awareness of environmental factors associated with it. Organizations are adopting green practices into their logistic practices to reduce the impact of their daily activities on the environment in the form of improper waste management, carbon dioxide emissions, greenhouse gases

emissions (Agyabeng-Mensah et al., 2020). The importance of adopting these practices is to ensure the safety and welfare needs of employees, other involved stakeholders and the environment itself (Longoni et al., 2018; Khan et al., 2018; Zaid et al., 2018). The concept of green warehousing is also gaining strength with the idea of adopting energy-efficient handling of technologies, green packaging and other strategies related to sustainability (Çankaya & Sezen, 2019).

Futurist has predicted that a third of jobs that exists today would likely be taken by technologies like AI, robotics and algorithms by 2025. However, it is little to know in literature about how employees may perceive this current change in their job places and how they are preparing for these potential changes in their jobs and careers (Brougham & Haar, 2018). Nevertheless, findings of the Accenture web-based survey with almost 1014 supply chains concluded that actual use of big data analytics is limited, when most of the companies found difficulty to adopt it in terms of investment prediction, security risks and lack of business cases for analytics (Hopkins & Hawking, 2018). Research confirmed a gap between the big data analytics in supply chain literature with the real practices (Wang et al., 2016). The lack of perceived benefits, increased financial cost, high learning cost and employee acceptance level are some of the barrier towards adopting intelligent logistics technology (Shankar et al., 2021)

2.3.2 Application of intelligent logistics in retail organization

From observation, it can be perceived that consumer adoption of technology drives retailer adoption of technology (Shankar et al., 2021) e.g., consumer use of certain apps made retailers upgrade their technologies to be listed in apps and consumer shopping trend changes also affects retailer use of technologies. Nowadays retail organizations are investing heavily in adopting self-service technologies like ATM, self-check-out etc., that can help in their business growth (Stein & Ramaseshan, 2016). Several innovative technologies have been deployed to enhance customer buying experience such as ATMs, interactive displays equipped with touch screens, digital signage and applications for mobile phones which are further backed up by radio frequency identification (RFID) and quick response (QR) codes (Wacker et al., 2018). Retail distributions systems are considered multi and Omni-channels where customers can place orders through multiple ways online, physically and online in store. Retailers are developing their analytical capabilities to better understand their customer needs, providing on demand service dynamically and managing the flow of goods in the supply chain successfully (Grewal et al., 2018).

The cost of data storage and processing has been continuously decline with the rise of cloud computing, retailers are acquiring more data including the data of purchased items from enterprise systems e.g., quantity purchased, price, size of discount applied if any, composition of shopping basket and time or date of purchase and the customer's social media and demographic information (Grewal et al., 2017) which is helping them to reduce their customer churn rate and also helps to improve customer experience. Big data allows retailers to deploy massive data warehouses with multiple datasets to cover unique insights. With the help of data that provides customer insight through their demographics' information and loyalty, they can build demand models that manage their inventory and labour cost effectively (Grewal et al., 2018). Nowadays, data acquisition is not a problem anymore, the real challenge is to make the best use of that data for operational and strategic business (Gobble, 2013). According to a survey of 100 senior executives of fortune 1000 companies, more than 70% of the participants want to enhance their "time to answer" through big data (Ferguson, 2013). However, findings

of Accenture web-based survey with almost 1014 supply chains concluded that actual use of big data analytics is limited, when most of the companies found difficulty to adopt it in terms of investment prediction, security risks and lack of business cases for analytics (Hopkins & Hawking, 2018). Another Research confirmed a gap between the big data analytics in supply chain literature with the real practices (Wang et al., 2016).

However, researches based on Porter's value chain model indicates an increased economic sustainability can be attained with the applications of IoT tools, Big Data technologies and cyber physical systems (CPS) (Nagy et al., 2018). In modern industries, the usage of AGV is generally justified in the market when the cost of labour is nearly equal to the cost of using AGV (Qi et al., 2015). In addition to the above technologies, intelligent logistics services (ILS) are also available in the retail industry along with some intelligent features like automation, transparency and connection (Hutchison & Mitchell, 2008). Therefore, it can be deduced that ILS have become another popular tool to improve customer service experience and enhance supply chain competitiveness (Liu et al., 2021). This technology when integrated with IoT, Big Data, internet plus, is widely used by some of the world leading global companies like Apple, Tesla, as well as many other internet companies such as Amazon, Alibaba and JD logistics (Liu et al., 2021). The fundamentals of IoT is based on identifying radio frequencies (Dong et al., 2021). In today's world, IoT is gaining a lot of attraction in retail companies (Alam et al., 2015). In applications such as safety, control and anti-theft in organization warehouses and retail shops it is proving highly cost effective as well as efficient. IoT provides many empirical solutions to the problems which retail companies face such as in traffic control, the stakeholders are able to collect real time data about traffic over the streets and vehicles with the help of IoT (Kaiwartya et al., 2016). This can be used to predict the traffic flow over specific streets and also help in avoiding accidents (Ding et al., 2016). In the matter of implementation of IoT technology, it is seen that trust in technology indirectly influences the intention to deploy IoT in terms of perceived feedback (Tu, 2018).

Many of the technologies are Artificial Intelligence (AI) empowered that are reshaping the retail industry in a big way (Shankar et al., 2021). AI continues to blend rapidly in consumer's lives and retail transactions. Retailers are investing in heavily AI applications with an estimate to invest upto 6 billion dollars by the end of 2022 (Shankar, 2018). Some of the applications of AI in retail include personalization and recommendation systems, customer service management, supply chain optimization, inventory management and store task creation (Shankar, 2018). In context with the need of high information and automation, logistics and warehouses has produced intelligent warehousing robot which has been widely used by various retailer e.g., amazon warehouse has distributed almost 30,000 of such robots in its distribution centre (Wu & Ge, 2019). Robotics technology can enable retail companies to experience a wide array of advantages such as encouraging customers to have much better experience during shopping activities (Dinu, 2021). Features such as faster and intelligent guidance, minimal personal cost of the company will further increase their profits. (Bertacchini et al., 2017). Automated robot is also one of the applications widely used in retail with added advantages of economics benefits, reliability and ease of use. (Karabegovic et al., 2015.) As an economic benefit, less labour power is needed to perform trivial repetitive tasks which can be automated (Kruger et al., 2009). Thus, it helps to provide efficiency at the operational level of organization. In addition to economic advantages, there are also admiralties advantages which are gained by making use of automated robots (Dong et al., 2021). In such applications, automated robots are enhanced with decision making methods for parts supply operation which leads to more sustainable transportation solutions at the warehouse (Nia et al., 2017). In short,

new technologies such as micro cloud computing, robotics, 5G, AR, MR, IoT and drone etc., are significantly reshaping the retail industry (Shankar et al., 2021).

2.3.3 Benefits and challenges of intelligent logistics in retail organizations

Benefits

There are a huge number of advantages using intelligent logistics technologies into retails. Some of them are mentioned below:

- Cost reduction

Using robotics enables companies to reach a large number of potential customers in relatively lower costs (Dinu, 2021). But managing data of a huge number of customers comes with added challenges. This large volume of ever-increasing data can be handled very efficiently by artificial intelligence powered tools which require less time, money and effort as compared to last generation systems (Bradlow et al., 2017). This also leads to huge reduction in the human workforce and labour cost. Artificial Intelligent systems can effectively and at less price manage tasks which would require huge manual labour (Anica-Popa et al., 2021). As an example, in today's world intelligent shelves equipped with mesh and strain sensors, microphones and photodetectors can arrange and place grocery and other goods on the shelves and can also perform real time inventory such as update price, expiration date check and other store related work. (Quante et al., 2008; Inman & Nikolova, 2017).

- Inventory optimization

The cost for inventory is greatly reduced with the help of intelligent logistics (Dinu, 2021). Direct cost which includes storage cost and indirect costs which are calculated as the loss company faces – both are greatly reduced (Miller & John, 2010). Keeping track of the quantity of ordered products and order to replenish the stock is a very critical task as the entire profit of the company depends on it (Mousavi, et al., 2016). Therefore, inventory optimization plays a highly critical role for company survival and is a very crucial use case of Artificial intelligence implementations.

AI powered models can also be used to forecast fashion trends for the week (Kartal, et al., 2016). This is called predictive analytics (Priyadarshi, et al. 2019). It helps the retail organizations to determine the optimal number of products to be supplied and also helps to reduce the inventory for unwanted items which are being spoiled and kept on the shelves to minimize the waste costs of the company (Priyadarshi, et al. 2019).

- Revenue growth

By using AI powered analysis tools in logistics, one can simply remove the need to improve-after-sale services by setting the customer received profits as the source to help themselves to continuously search for exchange opportunities (Fujitsu, 2019). In today's retail market, companies are investing in intelligent staffed retail shops which combine AI and IoT, to support customer identification and commodity recognition (Xu, et al., 2020) to provide them a more personalised experience. Implementation of artificial intelligence in commerce is leading towards predictive market analysis, which helps in decision-making process, automation and

data transcription optimization, ultimately leading towards better customer experience (Dinu, 2021).

- Logistics efficiency

Robotics and artificial intelligence technologies have brought significant efficiency gains to the logistics industry, and they have advantages because of its economics, administrative, reliability and also ease of use in extreme conditions (Karabegovic et al., 2015). These gains are reflected at the operational level of the logistics business (Dong et al., 2021).

In addition to economic advantages, there are also admiralties advantages which are gained by making use of automated robots (Dong et al., 2021). In such applications, automated robots are enhanced with decision making methods for parts supply operation which leads to more sustainable transportation solutions at the warehouse (Nia et al., 2017). They are also operational in extreme condition (Lever and Ray, 2008). Not only that, IoT provides many empirical solutions to the problems which retail companies face such as in traffic control, the stakeholders are able to collect real time data about traffic over the streets and vehicles with the help of IoT (Kaiwartya et al., 2016)). This can be used to predict the traffic flow over specific streets and also help in avoiding accidents (Ding et al., 2016).

Challenges

The rise of intelligent logistics is at the same time as a double-edged sword. While the widespread use of intelligent logistics in the retail sector brings numerous benefits, they also pose new threats to retail organizations (Henderson & Pearson, 2011). Some of them are discussed as under.

Additional investments

There is a need for research and development to develop artificial intelligent systems that are suitable to perform tasks effectively (Huang and Rust, 2018). This requires additional financial investments to develop and maintain those intelligent systems (Anica-Popa et al., 2021). So the retailer needs to make a decision smartly on where to deploy AI powered systems in their business. AI in today's world has some shortcomings of being semi-autonomous. For this problem, “human in loop” approach is used (Makridakis, 2018). This is done so because human intervention is required to manage situations which require empathy, creativity, and critical thinking. Main use of AI is to enhance human capability and not to replace humans (Afza & Kumar, 2018).

However, intelligent logistics technologies also bring new investment components as the nature of logistics work changes with technologies (Huang and Rust, 2018), the type of equipment and talent will adapt accordingly (Anica-Popa et al., 2021). There is a need to use more financial resources of organizations for staff training or finding new suitable talent (Makridakis, 2018). At the same time, with the addition of new intelligent devices, companies have to spend more on equipment purchase and maintenance costs (Anica-Popa et al., 2021). The logistics worker jobs will gradually be replaced by robots and higher paid skilled labours associated with Intelligent logistics, thus also increasing the operating costs of Intelligent logistics.

- Government policies and strategy

The new technologies which are being developed need new strategies and policies from the government (Anica-Popa et al., 2021). There is a need for policies to be compliant with the emerging intelligent logistics which can be used to improve the performance and lead to more sustainable growth of the system. But this may lead to extra costs which is not quantifiable and can be low initially but keeps on increasing due to all the maintenance costs (Dong et al., 2021). So a strict evaluation of strategies and the policies is required with respect to social and environmental aspects (Dinu, 2021).

- Burden on employers and employees

While intelligent logistics can help retail organizations to pick goods more quickly, it also comes with added responsibilities on employees. The new intelligent logistics systems are placing a demand on logistics workers to maintain and supervise robotic work which requires high skills instead of the traditional picking of goods (Henderson & Pearson, 2011). This requires retailers to find and develop a logistics workforce with the specialist skills to adapt to the new intelligent logistics system changes. As intelligent logistics removes the low-skilled, tedious work of traditional logistics, the reduction in workforce needs to be supplemented by the creation of new tasks. (Acemoglu & Restrepo, 2018).

This also requires logistics workers to bring a degree of creativity and problem spotting skills. With the advancement of intelligent logistics, robotics and AGV technology, among others, are constantly improving and more and more robots are replacing manual labour (Henderson & Pearson, 2011). This has put a squeeze on the jobs of traditional logistics workers. One reason for the pressure on logistics workers is the fear that robots will replace their jobs (Scheiber, 2018). Another comes from the need to learn new skills. Due to the increased skill requirements of the workforce for intelligent logistics, many retail organizations are requiring logistics workers to acquire higher skills to manage intelligent devices (Scheiber, 2018). The lack of perceived benefits, increased financial cost, high learning cost and employee acceptance level are some of the barriers towards adopting intelligent logistics technology (Shankar et al., 2021).

- Customer privacy

Customers are the main beneficiaries of intelligent logistics, as intelligent logistics helps them with a better customer experience (Byrum, 2018). However, such benefits come with a price of sharing their personal information. Retail organizations obtain information from the customer about his harvesting address, shopping and browsing history, etc., to enable better stock allocation (Mahmoud et al., 2019). But the customer's personal information is also exposed to the retail organization. While more and more customers now understand and accept the need to provide personal information to retail organizations to ensure the availability of the products they want, most customers do not like their browsing and purchasing history to be known to other organizations (Johnston, 2018). This can also lead to a distrust of retail organizations by customers.

- Other security risks

When intelligent logistics-driven retail services encounter technical failures, worse outcomes can occur (Henderson & Pearson, 2011). In Amazon's Arizona intelligent warehouse, for example, a robot at work suddenly malfunctioned. It sprayed 54 Amazon workers with bear re-

pellent. This led to 24 people being taken to hospital, with one of the injured in a life-threatening condition. Other workers were treated at the scene (Humphries, 2018). Incidents like this need to provoke us to think about the potential threats that intelligent logistics technology can pose.

2.4 Thematic overview

The underlying table 2.2 highlights the main themes and sub themes of our topic of research along with the references of literature found for each theme, with the help of which a framework was derived for further analysis.

Table 2.2: Thematic overview

Theme	Sub-theme	Supporting Literature
Intelligent logistics	Logistic	Lummus et al,. (2001); Meidutė,(2005); Heskett et al., (1964); Bowersox, (1986); Johannessen et al., (2002); Solem(2003); Dehler, (2001); Kotzab (1997). ; Mollenkopf et al.,(2000); Luttwak (1971); Islam et al. (2013); Speranza (2016)
	Transformation of logistics to intelligent logistics	Ballou,(2006);K. Wang,(2016); Amr et al., (2019); Lehmacher et al,(2017); Hydro et al., (2013); Trappey et al., (2017); Grant et al, (2006). ; Mcfarlane et al., (2017).; Grzybowska et al., (2020); Li et al.,(2018); Schramm-Klein & Morschett, (2006); Innis and LaLonde, (1994) Daugherty et al., (1998) Morschett, (2002).
	Emerging technologies in intelligent logistics	Wu & Ge (2019); Speranza (2018); Hübner et al (2016); Vavrík et al (2017); Atzori et al (2010); Malik et al (2017); Xu et al (2014); Hopkins & Hawking (2018); Mcafee & Brynjolfsson (2012); Grewal et al (2018); Sandeep et al (2021) ; Winkelhaus & Grosse (2020); Wamba et al., (2015); Ghosh (2016); Bakshi (2012); Raman et al., (2018); Wang et al (2016); Lai et al (2018); Yang et al (2017); Kong et al (2015) ; Qu et al (2016); Qi et al (2015); Liu et al (2021); Li et al (2018); Dong et al (2021); He et al (2014); Wu et al(2018); Crainic et al (2018); Foster & Rhoden (2020)
Historical development of retail org	Retail organization	Waker et al (2018); Niemeier & Naylor, (2012); O'Sullivan, (2012); McGurr & DeVaney, (1998); Hübner et al.,(2016); Gallino & Moreno, (2014);
	Significance of logistics in retail organization	Schramm-Klein & Morschett, (2006); Lorentz & Lounela, (2011). ; Sandberg et al., (2011); Kihlén, 2007). ; Abrahamsson & Rehme, 2010).; Fligstein et al., 1990).; Ltifi & Gharbi, 2015); Forslund & Jonsson, (2007); Lohman et al.,(2004); Theodoras et al.,

		(2005); Lorentz & Lounela, (2011); Wiese et al. (2012)
Role of intelligent logistics in retail organization	Current demand of logistics in retail organization	Zheng et al., (2019); Shen, (2017).; Shankar et al., (2021); Demirkan & Spohrer, (2014); Bouzaabia et al., (2013); (Castro et al.,(2012).
	Application	Shankar et al., (2021); Stein & Ramaseshan, (2016); Grewal et al., (2018).; Nagy et al (2018); Liu et al., (2021); Bertacchini et al.,,(2017)
	Benefits and challenges	Dinu, (2021); Bradlow et al., (2017); Anica-Popa et al., (2021); Quante et al., (2008); Inman & Nikolova, (2017); Miller & John, (2010). ; Priyadarshi, et al. (2019).; Fujitsu,(2019); Henderson & Pearson,(2011); Acemoglu & Restrepo,(2018)

2.5 Derived theoretical framework

With the help of all the literature review performed in this chapter, a theoretical framework was developed by the authors as shown in Figure 2.2 to provide a structural view of the deduced outcomes of our literature study and to provide guidelines for our empirical findings in later chapters of this thesis. The derived theoretical framework is an amalgamation of two concepts: one is the intelligent logistic and other is the effect of intelligent logistics with respect to retail organization. This derived theoretical framework is developed by taking some inspirations from the inductively refined framework of logistics 4.0 by Winkelhause and Grosse in 2020 as our findings seems to support the findings of this systematic review towards new logistic system.

Our framework is divided into four main sub-sections i.e., external triggers, internal triggers, intelligent logistics technologies and the outcomes of intelligent logistics. The first level of the framework highlights the external triggers which influence the evolution of intelligent logistics primarily due to the change in behaviour and demands of customers or the constructive disruptions in business landscape due to paradigm shifts or other environmental factors which includes sustainability and governmental policies. All these factors constitute the external triggers that have caused this evolution of logistics to intelligent logistics. Winkelhaus and Grosse in 2020 in their extensive research on intelligent logistics also came up with similar findings.

On the same level as external trigger, there comes the role of internal triggers as well which are mainly the triggers initiated from within the organization as the result of their business needs and goals to keep functioning. With the steadily increasing logistics volume of the company over the time, they need new solutions to handle their business needs effectively in order to reduce their overall logistic cost and also to increase their logistic revenue as well as to induce business efficiency in their operational and strategic tasks. All these factors constitute internal triggers from within the retail organization (Dehler, 2001; Kotzab, 1997; Mollenkopf et al.,2000)

The second level of this framework leads to the role of intelligent logistic technologies in providing efficient solutions to both external and internal triggers with the help of constantly emerging technologies and digital transformations. These technologies are further divided into two categories: Robots which refers towards the hardware technologies being used in intelligent logistics e.g., AGV, drones, stacker cranes etc, and AI which refers more towards the applications and software technologies side of intelligent logistics e.g., IoT, Big Data, cloud computing, intelligent systems and block chain etc. By using these technologies, improved efficiency, improved responsiveness and increased transparency and reduced errors were reported in literature (Hydro et al., 2013; Dong et al., 2021; Kihlén, 2007; Winkelhaus & Grosse, 2020).

The third and final level of this framework highlights the resulting outcomes of embracing intelligent logistics in retail organizations which includes both the benefits as well as the challenges. Some of the identified benefits in literature were in terms of time, quality and cost of the business (Fujitsu, 2019; Xu, et al., 2020; Bradlow et al., 2017; Anica-Popa et al., 2021). These derived benefits also seemed to be aligned with the findings of inductively refined framework of Winkelhaus and Grosse in 2020. Intelligent logistic facilitates the retail organization in inducing timeliness and improved response time in their business which in turns add to improved customer satisfactions, in terms of quality. It also helps in enforcing optimization in operational and strategic tasks of business (Miller & John, 2010; Mousavi, et al., 2016; Priyadarshi, et al. 2019), and in terms of finances, reduced cost was reported in literature as one of the benefits if using intelligent logistics (Dinu, 2021; Quante et al., 2008; Inman & Nikolova, 2017). Nevertheless, all these benefits come with some counter challenges as well, the most common challenges identified in literature is the increased research and development cost, shortage of highly skilled people to work with these technologies as well as increased unemployment of clerks or labourers and also the resultant security and safety issues related to intelligent logistics (Huang and Rust, 2018; Anica-Popa et al., 2021; Afza & Kumar, 2018; Makridakis, 2018).

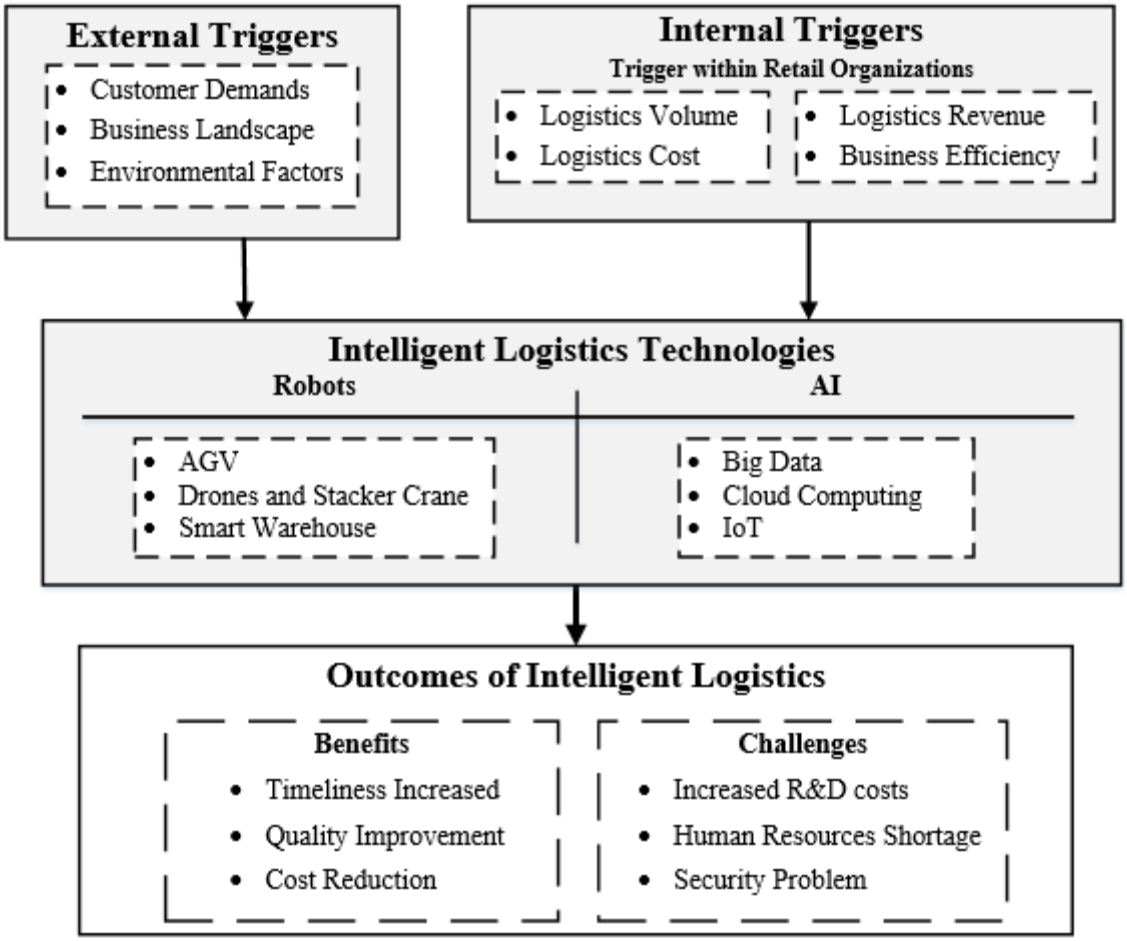

Figure 2.2 Our derived theoretical model of outcome of intelligent logistics in retail organizations (created by authors)

3 Research Methodology

The chapter explains the research methodology we adopted to carry this research and to investigate our research question in a more structural manner. This chapter explains chosen research strategy, selected data collection method and the techniques adopted by the authors for data analysis and provides description of the measures taken to ensure the scientific quality as well as the ethical considerations for undertaking this research.

3.1 Research strategy

To perform this research, the author decided to use qualitative research methodology due to several reasons discussed in this section 3.1

According to Recker in 2013, it is the research question that helps to choose the right research methodology. As qualitative methods aim to find answers for the "what", "how" and "why" phenomenon rather than "how much" and "how many" (McCusker & Gunaydin, 2015), qualitative research strategy seems to be pretty well aligned with our research question that focuses on the "what" perspective of intelligent logistics (*what the outcome of is intelligent logistic in retail organization*?)".

As the topic of our thesis is still new to research that have a lot of room for more exploration and involves many emerging concepts related to innovative technologies of intelligent logistics which are not fully researched yet, so according to Recker in 2013, qualitative method is the most suitable method for exploratory research where the phenomenon is not fully researched yet (Recker, 2013). This provides the authors much assurance to choose this research strategy for carrying out this research further.

According to Patton in 2015, researchers that analyse qualitative data strive to understand the bigger picture of phenomenon and qualitative strategy helps to develop a holistic overview of the topic under research. This seems to be aligned with the aim of this research to achieve a holistic view of the outcomes of intelligent logistics in the retail sector. As qualitative research helps in exploratory studies helps to uncover complex, multifaceted, or even hidden phenomena that can lead towards a more multi-perspective (Recker, 2013). With the help of qualitative methodology, the authors aim to find a more comprehensive view of different stakeholders related to retail business, their current role in the company and the current challenges retail companies are facing while making this technological shift.

Another significant quality of the qualitative method is its ability to capture thick description of data (Patton, 2015; Ponterotto, 2015). The authors also aim to find descriptive information with the help of qualitative rich data collection techniques.

However, performing qualitative research comes with the added responsibility of using appropriate skills to make unbiased interpretations. The authors plan to carry an inductive analysis which is also very much aligned with our selected method as qualitative research facilitates bottom-up analysis and helps to develop patterns, themes and concepts into abstract units from the collected data (Recker, 2013). As the topic of our research is still new to explore and

do not involve well developed theories to test and validate deductively therefore inductive analysis seems to be much appropriate choice to carry out this research.

3.2 Data collection method

In order to perform this research, the authors planned to carry a detailed literature review followed by interviews, one of the most prominent methods to carry qualitative research in terms of its insightfulness (Recker, 2013) as our main tasks for data collection method.

3.2.1 Conducting literature review

According (Bhattacherjee, 2012) in 2012, there are three main incentives to perform a literature review: analysis of the current state of knowledge in the domain of research, identification of the main authors, articles and developed theories in that area and the identification of knowledge gaps in that research area. Therefore, the significance of literature review cannot be overlooked in any research. As performing a good interview is all about the art of questioning and interpreting the answers right (Qu & Dumay, 2011) so to achieve this goal, a thorough study of literature is required as a prerequisite.

Conducting qualitative research requires various skills, in order to collect useful data, the researcher needs to develop as much expertise in the relevant topic as possible to ask informed questions (Qu & Dumay, 2011). Therefore, literature review was conducted to facilitate the formulation of interview guides and interview questions. A thorough literature review was carried out which includes detail research on topics with keywords:

- “Logistics Definitions”
- “Logistic 4.0” OR “Intelligent Logistics” OR “Smart Logistics”
- “Technologies” AND “Logistic 4.0” OR “Intelligent Logistics” OR “Smart Logistics”
- “Retail Organization” OR “Retail Sector”
- “Logistic 4.0” OR “Intelligent Logistics” OR “Smart Logistics” OR “Intelligent logistics” AND “Retail Organization”
- “Current demands of logistics” AND “Retail Organization”
- “Benefits of Intelligent Logistics” AND “Retail Organization”
- “Challenges” OR “Barriers of Intelligent logistics” AND “Retail Organization”

For this purpose, we chose Lund university publication database Lubsearch as well as google scholar where more than 100 articles were explored, and a literature review was formulated. After conducting literature review, the thematic overview of literature was designed to facilitate the identification of themes and sub themes with reference to supporting literature. A derived theoretical framework was also developed by the authors to facilitate the later chapters of analysis and discussion in a structural manner.

3.2.2 Interview

In order to accomplish this qualitative research in a useful manner, the authors planned to conduct interviews with respondents. Interviews are a more customized form of data collection

(Bhattacherjee, 2012) to get a subjective understanding of the research under discussion (Recker, 2013). The authors planned to perform descriptive interviews in order to gather a thick description of the current industry practices and the role of intelligent logistics in the retail sector. Authors planned to perform descriptive interviews as they help to promote subjective understanding by focusing on comprehensive conceptualization (Recker, 2013).

However, interviews come with its challenge of reflexivity, inaccuracy, artificiality as the authors and respondents are not familiar to each other (Recker, 2013). To handle all these challenges at our best, the authors selected semi-structured interviews to make them less formal and accessible. The reason to choose the semi- semi-structured approach was to gain benefits from its flexible predefined structure where new questions can be brought up during the interview as the result of how respondent responded to the previous one (Recker, 2013). Also the conversational pattern can further be proceeded with bi-directional discussion and follow-up questions later on (Recker, 2013). A guided questionnaire was formulated in a consistent and systematic manner, with the help of a designed thematic overview and derived theoretical framework in the end of the literature section. This questionnaire was a product of thorough literature study and sound theoretical foundation. Adopting a semi-structured approach of interviews made the respondents more comfortable in the interview settings and promoted expressiveness while performing interviews. By following the guidance provided by (Qu & Dumay, 2011) in performing semi-structured interviews, the authors aim to remain open to new and unforeseen phenomena rather than following a strict protocol and ready-made framework which could make the extraction of content limited in the analysis phase.

Author also carried two interviews with Chinese companies in their native language as they are more expressive to give their opinion in their native language, these interviews were then translated to English with the help of both software Nvivo as well as manual editing where required. The authors also took permission from all our respondents to record and transcribe the interview for later data extractions. One of the added advantages of recorded interviews is no matter how extensive notes you have taken during the interview, it is always possible to return towards the interview to extract more descriptions and analysis later on (Walsham, 2006).

Due to the prevailing situation of pandemic and the dramatic shift of education towards e-learning, it was also not possible to carry face to face interviews at present, so the authors planned to perform the interview online. Face to face interviews, although more time consuming and resource intensive (Gideon, 2012), helps to gather richer descriptions in terms of gestures, expressions and body language and such contextual details might not be possible to gather through online interviews. But we tried to overcome this shortcoming with the help of video conference interviews which seem the only replacement in the prevailing circumstances.

For the purpose of this master thesis, we conducted six interviews which were transcribed later on. Transcription is the process of transforming the oral data into written structured format to prepare it for analysis (Kvale & Brink-mann, 2009). These transcriptions were completed with the help of software tools as manual transcriptions are time consuming as well as prone to human errors. To transcribe the interviews of English language, the authors used “Maxqda” which is one of the most popular tools for qualitative data analysis. As mentioned earlier, the authors also had two of our interviews in Chinese language and “Maxqda” didn’t provide any support to transcribe the Chinese language interviews so for this purpose the authors used another tool called “Iflytek.”

3.2.3 Designing the interview guide

This semi-structured interview guide was designed by the guidelines provided by Myer and Newman in 2007 for how to script the semi-structured interview guide (Myers & Newman, 2007). This guide includes four main steps:

- Preparing the opening
- Preparing the introduction
- Preparing the key questions
- Preparing the closing

Other things which were kept in consideration when preparing this interview guide was to not over- prepare the script and to avoid using strict protocol and framework as semi-structured interviews demand flexibility, openness, and improvisation (Myers & Newman, 2007). The transcripts and recording were kept confidential and secure. Below table 3.1 is the elaboration of the designed interview guide for undertaking this research.

Table 3.1 Interview Guide

Theme	Type	Main Question	Interview Question	Supporting Literature
Opening	Opening question		• Is it okay if we record this interview? • Would you like to be anonymous or public?	
Introduction	Introduction		• Please briefly introduce your company business activity • Please introduce your job duty.	
Intelligent Logistics	Key Questions	How much logistics matters to the company's business activities?	• What is the daily logistics amount of the company? • How has the company's logistics business volume changed in recent years? • What role do you think logistics plays in terms of company revenue, customer ratings, etc.	K. Wang,(2016), Amr et al., (2019), Lehmacher et al,(2017), Hydro et al., (2013), Trappey et al., (2017), Abrahamsson & Rehme, 2010)., Fligstein et al., 1990).,

		What is your perception about intelligent logistics	• Have you heard about the word "Intelligent Logistics"	
The Intelligent Logistics impact to retail organization	Key questions	What kind of applications and technologies are used for logistic operations	• Can you share with us one or two successful application cases or technology? • What kind of intelligent logistics technology does your company use?	Mcafee & Brynjolfsson (2012), Grewal et al (2018), Sandeep et al (2021) , Winkelhaus & Grosse (2020), Wamba et al., (2015)
		What are the changes undertaken by the retail companies to implement the Intelligent logistic	• How could you apply these intelligent logistics technologies into your existing logistic system? • What is the impact of these technologies on your business? • How has your company's revenue changed as a result of using Intelligent Logistics?	Dinu, (2021), Bradlow et al., (2017), Anica-Popa et al., (2021), Quante et al., (2008), Inman & Nikolova, (2017), Miller & John, (2010)
		What is the level of customer & employee	• What has been the reaction of your customers after using Intelligent Logistics?	(Henderson & Pearson, 2011), (Acemoglu & Restrepo, 2018), (Scheiber, 2018)

		satisfaction	• What are the views of logistics workers on Intelligent logistics after the company has used Intelligent logistics technology?	
Benefits and challenges in intelligent logistics	Key questions	What is benefits of intelligent logistics?	• What benefits do you think intelligent logistics has provided in your business?	Priyadarshi, et al. (2019)., Fujitsu,(2019)
		What is the challenges of intelligent logistics?	• Do you have any dissatisfaction with the current intelligent logistics technology? • Does intelligent logistics add more cost to your company logistics? • If so, how do you see the increase in costs, or what approach would you take to address this issue.	Inman & Nikolova, (2017), Miller & John, (2010). , Priyadarshi, et al. (2019)., Fujitsu,(2019), Henderson & Pearson,(2011), Acemoglu & Restrepo,(2018)
		What does improvement the manager want?	• What is your or logistic manager's plan for future work in the area of logistics?	
Closing	Closing question		• Do you wish to add something more before closing? • Can we contact you again in	

			case of any additional questions	

3.2.4 Selecting respondents

For selecting respondents for this research, authors followed the guidelines provided by Terhanian and Bremer (2012), which states interviews should rely on the sampling-based knowledge produced by reviewing the literature carefully, rather than random sampling.

As the theme of this research is to investigate of the outcomes of intelligent logistics in retail organizations. According to the conducted literature review, there is a need to explore both the benefits as well as the challenges associated with intelligent logistics technology for retail organizations. For this purpose, the first step followed was to shortlist the respondents from the retail sector. As there are many different types of retail companies of different sizes, with different business needs and variant uses for intelligent logistics, a careful selection was required. Secondly the intent was to cover as many scenarios of intelligent logistics applications as possible. Therefore, the authors decided to select retailers with different business domains. In order to obtain as much information as possible, authors also limited the respondent's selection to managers, directors or general managers of logistics departments.

The respondents were selected by keeping the following things in consideration:

- The retail organization must operate on a large scale or is a chain retail organization so that it can have a sufficiently large volume of logistics operations and experience of intelligent logistics technology.
- The business model of the respondent organization must be as diverse as possible.
- The organization must be as typical or leading in the retail sector as possible.

When selecting our respondents, authors consider the following points:

- The respondent must work in the logistics sector and is a manager and above.
- The respondent must have work experience in intelligent logistics.
- The respondent must have access to the organization's logistics data and logistics technology.

Based on the above points, invitations were sent for interviews to suitable respondents and organizations via email, LinkedIn. Authors also attached the interview guide and asked if respondents would be willing to be interviewed. Based on the feedback from the respondents and organizations, interviews with six retail organizations were conducted. Below table 3.2 provides the detail of respondents and the interviews conducted along with dates and medium used.

Table 3.2 Overview of the respondents' information

Respondent	Role	Organization	Business activities	Duration	Date	Type
1	Head of the Intelligent Warehouse	Jingdong	E-commerce retail organization	75 minutes	May 8th 2021	Zoom
2	Logistics Management Manager	Anonymous	Food retail company	55 minutes	May 8th 2021	Zoom
3	Director of logistics department	Anonymous	Electrical appliance retail company	65 minutes	May 10th 2021	Zoom
4	Logistics manager	Anonymous	Grocery shop chains	63 minutes	May 11th 2021	Zoom
5	Algorithm director of Logistics department	Alibaba	E-commerce retail organization	126 minutes	May 12th 2021	Zoom
6	Algorithm technical manager of Logistics department	Amazon	E-commerce retail organization	107 minutes	May 13th 2021	Zoom

3.3 Data analysis method

After the data collection was completed, the next step was to start the data analysis phase of research. According to Recker, 2013, one of the main attributes of qualitative research is to

analyse thick description data without any knowledge of which part is more relevant to deduce results (Recker, 2013). Unlike quantitative analysis, qualitative analysis relies heavily on the analytical skills of the researcher and his contextual awareness from where the data has been collected (Bhattacherjee, 2012). Therefore, a structured approach was required to analyse the data correctly. Although there are several techniques for qualitative analysis (Recker, 2013). For our thesis, we selected the techniques of memoing and coding as it seemed to be the most appropriate choice for us to perform data analysis.

According to Recker and Bhattcherjee, memo writing is the technique of writing reflections or taking subjective notes of what happened right after the data collection to draw relationships and categories (Bhattacherjee, 2012; Recker, 2013). According to Charmaz in 2006 the most significant contribution of memoing is that it maintains productivity in research and also memoing is key strategy of maintaining communication, interconnectedness and consistency among researcher (Birks et al., 2008). It helps to pen down the ideas and perceptions of mind while conducting the data collection which can be useful in the later process. So right after conducting the interviews, the authors also discussed the content of the interviews and reflected what they observed and made notes to help later in the data extraction phase.

Another technique adopted was coding. According to Recker in 2013, coding has been a useful technique to transform huge amounts of data into meaningful information. As coding can be either concept driven, or data driven (Kvale & Brinkmann, 2009). We decided to go for concept driven coding as we had already developed a derived theoretical model in the earlier phase of thesis (Figure 2.2) based on our literature study, so therefore, concept-driven coding seemed a more well-suited choice in our case. Below is the table 3.3 that was designed after careful subjective analysis.

Table 3.3 Coding table

Concept	**Aspect**	**Code**
Logistics	Revenue,	LR
	Cost	LC
	Volume	LV
Technologies of Intelligent logistics	IoT	IoT
	AGV	AGV
	Big Data	BD
	cloud computing	CC
	Smart Warehouse	SW
	Artificial Intelligence	AI
	Robots	RO

	Other Technologies	OT
Retail organizations	Current Changes	CRC
	Significant Logistics	SL
	Government policies	GP
Outcomes of intelligent logistics in retail organization (Benefits & challenges)	Customer Satisfaction	CS
	Efficiency	EF
	Intelligent Logistic Cost	ILC
	Employee Acceptance Level	EAL
	Sustainability	SS
	Future Plan	FP
	Manager Duty	MD
	Cost Reduction	CR

In order to add codes to the transcription, the coding software tool Nvivo 12 was used, which is a great academic tool to find insights in qualitative data in a structured and well-organized manner and therefore recommended by Recker in 2013. But still this tool has a certain limitation to assist with coding through its functions, as most of the interpretive task was completed manually by researchers as it requires subjective understanding of the concepts. This subjective understanding was specially taken into consideration because of the guidelines of Recker and Bhattacherjee. Both techniques of memoing and coding proved useful in providing support to us in the data analysis phase.

3.4 Scientific quality

According to Bhattacherjee in 2012, the scientific quality of research is ensured by two common parameters, reliability and validity. He also mentioned that reliability and validity combine to become psychometric properties to measure the adequacy and accuracy of research.

Reliability refers to the degree of which the measure of construct is consistent (Recker,2013) or it renders the same result assuming the underlying phenomenon is not changed. In other words, the measure of construction yields the same result every time (Bhattacherjee, 2012). In order to eliminate the element of inconsistency and decrease the element of subjectivity for this research, we also took measures. First, we tried to formulate the interviews by taking help from interview guides. Also due to the subjective nature of semi- structured interviews being conducted, we took help from the existing literature to perform an informed interview and to compare our results with the existing research found in literature. Also, same questions were

asked from all the interviewees to keep the findings consistent. The respondents selected for this research also belong to the same designations of managers and directors of their organizations to keep the findings consistent.

Validity refers to the appropriateness of data collection techniques to find answers to the research question (Recker, 2013; Mohajan,2017; Bhattacherjee, 2012). Internal validity includes the appropriate choice of methodology, the data collection methods. To ensure internal validity our choice of research strategy is justified in section 3.1 of this chapter. Throughout this research, we tried to achieve congruence between the literature study and our observation through interviews. Sargeant suggests that in qualitative research there are two main strategies to promote rigour and quality in research: ensuring the quality or 'truthfulness' of the data and the quality or 'credibility' of the analysis (Sargeant, 2012). The authenticity of the data is reflected in the quality of the data and the data collection process (Cleary et al., 2014). This seems to aligned with the aim of this research to provide authentic information by conducting the data collection process correctly.

External validity refers to whether the findings can be generalized (Bhattacherjee, 2012).To ensure the external validity, the interviews were conducted with retailers from a heterogeneous category of retail industry that belong to different domains with the aim to provide a holistic view of the retail industry and the results can therefore be generalized. For e-commerce retailers, we selected three of the world's largest retail organizations: Jingdong, Alibaba and Amazon. Therefore, the quality of the sample for the study was assured. The quality of the data analysis represents the credibility of the analysis (Hillyard, 2001). The views and beliefs of the researchers during the interviews and in the processing could potentially influence the results of the analysis (Sargeant, 2012). The authors avoid making biased statements in interviews that could have influenced the respondents point of view to keep the discussion neutral. For the analysis of the data, we used one of the most common software packages for qualitative research: Nvivo. This allows us to guarantee the reliability of our data.

3.5 Ethical consideration

Interviews are a critical part of gathering data for any research. However, several ethical considerations need to be taken into account regarding both the privacy of the people interviewed, as well as the quality of the data that is collected. According to Patton (2015), all interviews must be voluntary. Thus, the interviews we performed were all free will and completely voluntary with no incentive for the participants. Furthermore, they were given the option to opt out of having their names published, in which case we replaced their names with pseudonyms on permission. In cases where the participant may be identified even without disclosure of their name (due to their views, for instance), further steps were taken to conceal their identity (Creswell, 2017). Authors guaranteed that the interview did not cause any physical or mental harm to the respondents (Bell et al., 2018). The publication rights to the respondents were declared and consent was obtained from other authors before the interviews (Creswell, 2017).

Due to the prevailing circumstances, the interviews were held online over video calls where special permissions were requested from respondents about recording the interviews. Respondents were also informed that their recording will be kept completely confidential and will only be used for master thesis purposes. Another challenge presented in this situation is

the safe storage of such recordings and other data from the interviews, which is a part of confidentiality. (Patton, 2015). This was addressed by moving interview data to secure cloud storage as soon as possible and by removing copies of respondents from our devices. The participants were also informed about this latter on.

Authors also aligned the research with the rights of research participants as outlined in Oates in 2006. This requires, in addition to the above-mentioned steps, that the interview participants are fully aware of the theme of the research and its context and that they may withdraw from participation at any time after first having agreed to it. To this end, we fully explained our research project in the interview invitation emails that were sent to prospective participants along with the interview guide attached to the emails so they can have a better idea about the content of the interview and can come prepared. Moreover, author tried to make the interview neutral and not designed in a way to change the subject's views or to elicit certain answers (Patton, 2015). The language of the questions was tried to keep completely neutral so that it does not compel the respondents to answer in a specific way or to take a certain view.

4 Empirical Finding

This chapter includes a detailed analysis of the semi-structured interviews performed for this research and elaboration of some interesting findings which is mapped on our derived theoretical framework (Figure 2.2). Therefore, the findings of this chapter are categorized with respect to the levels identified in our theoretical framework 2.2. The transcripts of these semi-structured interviews can be found in the appendices section. We refer to these transcripts in this section with a code like (1.4) or (2.6) which means interview 1 transcription line 4 or interview 2 transcription line 6 respectively.

4.1 Overview of respondents

We would like to start this section by giving a brief overview of our six respondents, their roles and responsibilities and some insightful details about their respective organizations.

R1 is the head of intelligent warehouse at Jingdong logistics and is mainly responsible for the transformation and development of Intelligent warehouse (1.4). Jingdong is one of the massive e-retailer in China in terms of volume and revenue as well as a major competitor of Ali baba and a member of fortune Global 500 companies. In past, Jingdong has been a popular online sales platform for electronic equipment in China but after 2010, they expanded their business growth to include other merchandise as well which includes food, clothes, and other daily necessities items: Many third parties' retailers are also using Jingdong platform to sell their own products (1.8).

R2 is the logistics management manager for his organization's intelligent logistics system whose main responsibilities is to manage intelligent logistics system and to regularly visit their offline shops to check the logistics of their warehouses (2.4). His organization is a multi-channel food retail company functioning both online and offline with product categories which include not only meat, fish, fruit and vegetables, rice, flour, and oil, that needs to be processed, but also pre-made products like dried fruits, baked goods, cooked goods and other products (2.6). They also sell local specialities depending on the city where offline shops are located as well as recommend different local specialities based on the city where the user is positioned with the help of their online app (2.7). Their outlets are in 12 cities with a total of 154 shops (2.7)

R3 is the director of his company's logistics department with a day-to-day job to check if their logistics orders are running properly and the supply chain logistics are in order, in addition to this, his main job is also to recommend ideas for the transformation of the company's logistics system (3.6). His organization is one of the leading home appliances retail chains. Initially the company sold small home appliances such as radios, fans, and televisions. Later they slowly developed an import business, importing appliances from Japan, Korea, the United States and many other countries ultimately becoming one of the largest electronic appliances retailers (3.8). At present they have more than 1,700 shops in over 400 different cities (3.10) and more than 260 warehouses (3.12). They have now established their own logistic company to reduce the cost of third-party service providers (3.16).

R4 is the logistics manager of logistics and distribution department at a grocery shop chain. He is mainly responsible for offline distribution work. His organization is different from other traditional grocery shops in that they have physical shops as well as offer online purchase and offline delivery. Customers can also have their goods delivered to their home after shopping in physical shops. Their organization is a multi-channel retailer offering both online or offline purchase and home delivery service (4.6). With more than 200 shops over 80 cities, they happen to be large chain of e-grocery shop retailer and were the pioneers for implementing multi-channel retailing and home delivery services (4.8).

R5 is working as an algorithm director for the Cainiao Logistics project under the Alibaba Group. His main responsibilities include to work on the intelligent route planning algorithm content of Cainiao Logistics project to improve their current order processing efficiency and to reduce their delivery time (5.8). Cainiao Logistics is focused on building an intelligent logistics network and open network of intelligent warehousing facilities throughout China, and even the world. This is achieved by creating logistics companies that cooperates with suppliers, and other models (5.10). The main goal of Cainiao logistics is to decrease waiting time by ensuring delivery within 24 hours in any region of the country (5.28).

Our last respondent, R6 is an algorithm technical manager of the logistics department at Amazon (6.4) and is also a member of the technology centre at Amazon headquarters (6.6). Although Amazon is divided into many countries like the UK, France, Germany, USA, etc., the same set of intelligent logistics systems is used worldwide but they may change in each country for local cost reasons (6.8).

4.2 External triggers

The external triggers include all those external factors that compels the respondent organization to make shift or to choose intelligent logistics. These factors are discussed as under:

4.2.1 Customer demand

When the authors asked about how the customer is perceiving their services and what transition they have experienced in customer behaviour after making shift towards intelligent logistic, all the respondents mentioned a highly positive feedback from their customers by mentioning they have significantly decreased errors in delivery and order delivery time have been highly improved which shows great satisfaction and appreciation from customer side (2.14; 4.28; 3.38;5.40;)

When asked from the R1 about how the customer feels for their product and services, he mentioned:

"(…) Consumers who have used Jingdong know that consumers can place their orders and have them arrive on the same day. Many consumers choose us because they believe our products are genuine and our prices are good. Another important reason is the high timeliness of Jingdong's logistics…in 2010, we also set up a door-to-door pick-up service. We were one of the first wave of retailers to offer a logistics catch-up service. It allows consumers to track and

check real-time logistics in real time via a mobile app and website. The use of intelligent warehouses effectively combines geographical advantages and facilitates more efficient delivery times" (1.14).

R2 logistic system was also highly rated among customers specially the delivery within 30 minutes of order was highly appreciated among customers (2.14).

R3 also mentioned a reduction in customer complaints after making a shift towards intelligent logistics by elaborating:

"Customer feedback is getting better and better. Our complaints about logistics have now dropped by 40%. This is a very significant improvement. We didn't even expect such good results. And especially after this outbreak, more people are choosing to shop online. Our logistics have all been very well received" (3.38).

R4 also reported high ratings of customers for their intelligent logistic delivery (4.28). He even mentioned the reason for having a competitive edge over the rest of the business is because our customers have a very high rating of our organization's logistic delivery (4.30). They have a separate customer evaluation section for every order to get data related to customer response for every delivery, from the data so far it can be seen that vast majority of customers are very much satisfied (4.18). R6 also claims that the reviews they receive from customers shows that they have a lot of trust in the Amazon delivery model (6.22). R5 organization is also very much keen to gather data from customers on a routine basis as customer logistic review. They also inform a highly positive response and appreciation of their services from the customer side after intelligent logistics (5.40).

R1, R5 and R6 mentioned that for customers it does not necessarily matter which delivery method they are using, what matters the most is how swiftly they can receive their orders (1.52; 5.22; 6.22). If they have a good experience of delivery, they will be more willing to order from the same platform again. But in addition to the speed of delivery, the quality of logistics is also very critical (5.22)

R5 mentioned that the customer complaints have now been reduced to 30% compared to last year (5.22) while R3 said that the complaints about logistics have now dropped by 40% after shifting to intelligent logistics (3.38). R1 also mentioned that they rarely receive any complaints from the customer now about lost items or wrong items being sent (1.34). This has also helped them to reduce the cost of additional claims and exchanges etc (1.48).

4.2.2 Business landscape

Almost all our respondents belong to organizations which are considered giant in industry with a huge logistic volume; some have about 10 million pieces everyday to deliver (3.12). So technically it seems impossible to keep functioning with traditional logistic systems that rely heavily on manual handling; therefore, these retail organizations made this shift towards intelligent logistics much more promptly by sensing the changing business landscape much earlier in time.

R1 mentioned the changing business landscape of retail companies by saying as more and more people started shopping online, the volume of orders increased significantly which made it impossible to handle the order picking manually that ultimately leads towards taking help

from robots to the picking autonomously. He also mentioned that after the covid-19 pandemic, many retail organizations that rely on manual picking were forced to suspend their operations and make a shift towards the unmanned handling of orders (1.28).

When asked by R3 about the changes in their business over the years, he mentioned that previously they have been relying heavily on staff with little technological support which was much less efficient with a high error rate of picking the wrong package and occasional damage of goods too (3.289. This clearly indicates the inability of the traditional practices to manage the huge volume of daily orders but with intelligent logistics after using robotics, they were able to pick 34,5000 items in 12 hours which improved their efficiency compared to previously.

R4 with a total of more than 10,000 delivery orders per day, made a shift towards intelligent logistics 7 years ago in 2014 (4.20). R5 with a growing business of 100% parcels increase year by year (5.18) and with nearly one billion parcel delivery every year, increasing yearly (5.26), embraced intelligent logistics very long ago (5.24).

R6 has also experienced a significant increase in the number of orders specially after the pandemic year (6.18), with billions of parcels to delivery every year, they also made a shift 7 to 8 years ago in 2013-2014(6.36).

R1 mentioned that they also learned from their competitors who made a shift towards intelligent logistic earlier than them like Amazon & Alibaba (1.34) to make this shift as well.

4.2.3 Environmental factor

Out of six respondents, three of them showed keen interest in adopting a sustainable approach by mentioning it in their list of further goals which showed their intent on focusing on green logistics. R2, being a part of a retail food organization, mentioned the environmental aspect of logistics in his interview which shows their willingness to strive for a more sustainable approach to handle their waste production properly. When asked about what his next goal as a manager is. He mentioned promoting sustainable logistic methods as one of his main goals in future. When asked about how they plan to achieve this. He replied:

"Firstly, we will enhance the use of IoT technology to provide quality in the transport of our goods and reduce unnecessary waste" (*2.50*).

Other than R2, R6 also showed interest in improving sustainability of logistics along with increasing the efficiency and keeping the cost low at the same time. While discussing his plan further he mentioned

"*First of all, we want to be able to move towards low carbon transport. This includes more use of solar power, electric vehicles, and other means of transport*" *(6.78).*

Similar to R2 and R6, R5 also showed interest in doing more towards environmental sustainability in future. He mentioned that they aim to save more time and reduce cost at the same time to protect the environment from adverse effects of their daily activities as well. The thing that differentiated R5 from the other respondents is that they have already taken measures to incorporate sustainability in their organization since last year while the other organizations are

still in a somewhat planning phase or still think they can do a lot more in future to address the environmental concerns further. When asked about sustainability R5 replied further.

"*In fact, we are always committed to promoting environmentally friendly logistics for retailers. We are promoting green logistics through four specific measures: green parcels, green recycling, green intelligence and green delivery. In addition, Alibaba has been building a green packaging alliance since last year, and there are many multinational companies that are using environmentally friendly delivery boxes on a large scale*" *(5.54).*

4.3 Internal triggers

This part of our analysis includes the all-important internal triggers that influenced retail organization to makeshift from traditional logistic methods to intelligent logistics. The analysis throws light on how the logistic volume, revenue and cost of our interviewed organizations have developed over the time to make this paradigm shift inevitable.

4.3.1 Logistics volume

According to our interviews, we know that all these organizations have a large logistical scale. R1 is a global e-retailer with over one billion logistical packages per year (1.12). When it comes to big sales events such as 11.11 and 618, there will be more than 10 million pieces of logistics business a day (1.12). Also, R1 mentioned that their logistics volume has risen with every year.

"(...) During the epidemic in particular, our order intake went up by another 10 per cent, with a corresponding rise in logistics business of 12 per cent." (1.16).

Although R2 did not provide a specific volume of logistics, he mentioned that there were 3,000-5,000 items per day just in one shop that needed to be transported for turnover (2.10) while they have a total of 154 shops in 12 cities. R2 also mentioned that the volume of their logistics is on the rise (2.12).

As reported by the estimates of R3, more than a million items are transported between cities every day. At the same time, goods are delivered to different recipients in more than 260 warehouses in 200 cities. The overall volume of goods transported exceeds 10 million pieces (3.12). Also, R3's logistics volume has increased very rapidly in recent years (3.18).

"At that time, the volume of goods flow was only a hundred thousand pieces a day and there were less than 200 shops nationwide. But now the logistics business is already in the tens of millions of pieces. That's an increase of more than a hundred times! And since we set up our subsidiary, in addition to our internal logistics, we also undertake other businesses' logistics commissions." (3.18).

R3's material flow came from two ways. One is sales orders from within their platform and the other is orders from third party companies (3.40).

The R4 organization has two modes of operation: online shopping and offline shopping. In addition to the daily supply from the offline shops, they have several thousand online orders to

deliver every day (4.10). R4 indicated that the volume of deliveries in his area exceeded 11,000 orders per day (4.10). In common with other respondents, the volume of logistics for R4 is growing dramatically (4.12). Because they are a grocery shop, the chilled food and daily necessities are transported separately, which adds to the complexity of their logistics (4.12).

R5 and R6 organizations are two of the world's largest e-retailers: Alibaba and Amazon. The daily logistics volume of R5 exceeds 40 billion pieces. For example, on the 11.11 and 6.18 e-commerce sales days, the daily logistics volume can exceed 100 million pieces (5.16). R5 had the faster growth rate than any respondent.

" The volume of our logistics business has been growing tremendously every year. This year alone, we have seen a 100% year-on-year increase in the number of parcels received." (5.18). It has already doubled its logistic volume from last year.

R6 will ship more than 2.5 billion logistics packages in the US in 2020 (6.16). This figure does not include its logistics volumes in Europe, Asia, and other regions (6.16).

"(...) the number of online orders has increased by 20% compared to the same period in previous years." (6.18).

Although R6 has a low rate of logistical growth compared to R5, R6 is gradually expanding the share of it self-delivery services. Unlike R5, which is a collection of multiple logistics distributors.

This shows that all six organizations being interviewed have a significant logistics volume. This is one of the reasons that prompted them to use intelligent logistics (1.20; 2.22; 3.18; 4.20; 5.10; 6.16). Almost all respondents in the interviews said they were facing a huge increase in material traffic. R1 business activity is much similar to R5 and R6 in terms of the growth in orders from online orders, that is driving their logistics volumes up. R2 and R4 from the food industry have similar needs which has led to an increase in their logistics volume as well as its complexity.

4.3.2 Logistics cost

Logistics cost is an important factor for organizations to consider (Dinu, 2021). All six respondents mentioned the issue of logistics costs in their interviews before making a shift towards intelligent logistics. We asked them about their logistics cost situation, especially as they were before the use of intelligent logistics, to which respondents showed dissatisfaction (4.16; 6.26; 1.26;) except R2 whose organization is using intelligent logistics right from beginning.

R1 mentioned that it is not just the labour cost that constitutes the logistic cost previously but also the quantity of goods, time cost for sorting them and methods for distributing goods directly to consumers rather than pick-up points. All this required more manpower (1.26)

Although R2 was using intelligent logistics right from the beginning, they indicated that their main logistics costs came from transportation costs and losses in the transportation of fresh food as well as the labour and space cost associated with merchandise (2.28, 2.38). The R4 organization also deals with fresh ingredients. He indicated that they were also concerned

about the loss of fresh food during transportation due to on time delivery and transportation safety issues (4.16).

It was worth noticing that R3 mentioned another type of logistics cost: the logistics cost of large items. The R3 organization deals with some large electrical goods, resulting in much higher transport costs than organizations dealing with smaller retail goods (3.16). Moreover, the home delivery service also increases the cost of labour and logistics.

"*The transportation of large appliances is very different from the transportation of small items. ... Because the costs and requirements for transporting such small items are very low. .... But not so with large appliances… A refrigerator that is packed in a box would require at least two adult males to move it, in addition to the use of tools. Moreover, during the transport of a large appliance, it cannot be inverted, stepped on or drenched in rain. Otherwise it is easy to damage parts. The delivery of large appliances, moreover, requires a one-to-one door-to-door service. It is not possible for customers to pick up their goods at the counter themselves. If you were to find a logistics company in China that met these requirements, the cost of delivery would be very high…That's why we set up our own logistics department from the very beginning of our company" (3.16)*

For R5, price competition within the logistics industry, staff turnover, re-recruitment costs, and duplication of transport costs in logistics are a few of the key factors that lead to increased logistics costs. While speeding up logistics timelines, R5 would like to see further reductions in logistics costs.

Labour costs were a large part of the cost of logistics for R6 (6.36). Based on the descriptions of R6:

"(...) We used to need 300 workers to pick goods and operate equipment at all times in one warehouse." (6.62).

This number of logistics workers in the warehouse is ten times higher than the number of intelligent logistics warehouses (6.62).

R1, R5 and R6 organizations are all large e-retailers. They have more items to pick and are also more concerned about warehousing costs (1.26, 5.28, 6.26). Their logistics costs were placed more on labour costs (5.28). For them, how to make the warehouse pick more items in less time was one of the most important ways to reduce logistics costs (1.56,6.26). Also, the correctness of picking affects their logistics costs in terms of reduced error and wrong delivery. R1 and R5 said that problems with returns and exchanges due to picking errors not only increase the logistics costs of shipping goods back and forth, but also reduce customer satisfaction (1.24,5.20). Although R6 did not explicitly mention the relationship between picking correctness and logistics costs, he did say that correctness was one of the key reasons why they use intelligent logistics (6.56,6.62).

4.3.3 Logistics revenue

Logistic revenue can be seen in terms of reduction in logistics costs (1.14 ;2.40;3.16; 5.26;6.20), increase in the correctness of sorted goods (1.20; 5.14) and economic benefits due to increased customer satisfaction (1.14;2.40). All six respondents have their own logistics

services department, and, except for R6 Amazon, all five retail organizations use only their own logistics systems.

R1 mentioned the impact of logistics timeliness on customer satisfaction. The fast logistics service stimulates customers to continue shopping on the BOE website, thus increasing the organisation's revenue (1.14).

" (...) Consumers who have used Jingdong know that thanks to Jingdong Logistics, consumers can place their orders and have them arrive on the same day." (1.14).

Having established its own logistics system, R1 has improved the timeliness and accuracy of logistics delivery. The loss of goods during transportation has been reduced, which is also increasing their logistics revenue (1.14;1.26).

R2 companies have used intelligent logistics systems from the very beginning (2.42).

"These have significantly reduced our operating and logistics costs, which of course has increased our revenue" (2.40).

So, for R2, intelligent logistics has reduced costs for them, which includes aspects such as rational distribution of goods, fast transportation, reduction of goods loss, etc., which are all logistics revenue (2.28;2.38).

Also having their own logistics system, R3 and R1 mentioned some similar points. Since R3 has a huge number of large appliances that need to be transported, logistics take up a large part of their costs and revenues (3.16). R3 indicated that their own intelligent logistics system is tailored according to their business model. This allows them to deliver their large goods safely and quickly to their warehouses and customers at a low cost (3.16). This has enabled them to gain new benefits in terms of revenue from this. Their logistics system also provides transport services to other businesses, enabling them to generate additional revenue from their logistics operations in addition to their own logistics cost savings (3.14,3.16).

R4's logistics benefits come from a reduction in their own distribution logistics costs.

"For sure our own logistics system is less costly than a third-party logistics system. After all, our own logistics system is tailored to the characteristics of our company. And the intelligence of our system is comparable to that of other logistics companies." (4.18).

Also having a need to transport fresh food, R4 has many similarities to R2 in terms of logistics needs. R4 believes that the faster the logistics transport the better the reduction in fresh food losses and therefore the increase in revenue (4.42).

R5 is more focused on the development of the entire logistics system. He believes that reducing logistics costs and improving logistics efficiency can bring huge logistics revenue (5.14).

"Initially, we found that this problem existed in China, and even in many countries where the intelligent logistics industry is not well developed. The scale of logistics is very large, but the efficiency is very low. In terms of using data, logistics costs in China will account for around 15% of total GDP in 2020, while in Europe and America they will only account for around 8%. The higher the share is, the less efficient the logistics industry is. The total market for logistics

costs in China is in the order of $10 trillion, and every 1% reduction in logistics costs will result in hundreds of billions of dollars in revenue." (5.14).

He compares the efficiency of logistics between China and Europe and the US, thus suggesting that China's logistics to GDP ratio is nearly double that of Europe and the US. This means that there is still a lot of room for improvement in China's logistics profits. According to the example given by R5, every 1% reduction in logistics costs could lead to logistical revenue of hundreds of billions of dollars (5.14).

When we asked R6 about the logistics revenue, he gave a similar answer like R1. As a large e-retail organization, R6 would like to improve the storage and efficiency of the logistics warehouse (6.20). With an improved range of logistics and distribution, they can bring better satisfaction to their customers:

"What we want is for our customers to be able to order what they want through our Amazon platform, regardless of where they are in the world. We can also deliver to any location via our own logistics." (6.20).

Along with R3, as R1 and R5 also provide logistics services. R1 states that customers have a lot of trust in their timely delivery as well as its quality due to their sophisticated intelligent logistics system (1.48; 1.54). This has led many third-party retailers to also choose their logistics system and platform for selling their items as well, leading to overall increase in logistics revenue of respondent's organizations (1.14;1.26). Not coincidentally, R6 also indicated that many other merchants also enjoy their smart warehousing services. They store their products in their smart warehouses for better management and delivery (6.26;6.30). In summary, logistics revenue can come from many sources.

With the increase in logistic volume, cost and revenue over the years mentioned above (1.16 2.12; 3.12; 4.12; 6.16; 1:26; 2.38; 3.20; 4.16; 6.26; 3.16), it became unavoidable for these organizations to shift from manual handling to intelligent logistics in order to survive and to perform their business functions efficiently (5.22;3.28; 4.24; 1.14; 6.54; 2.31)

4.4 Intelligent logistic technologies

As all the respondents represent some of the well-established and leading organizations of the retail industry with huge logistic volume and revenue, all of them have shifted to intelligent logistics over the past few years and this transition is still in process to handle their business growth and volume efficiently. Although each organization incurred a heavy cost on research & development as well as on investment for deploying these intelligent logistics systems, but they showed considerable satisfaction with the outcomes of incurring these cost in-terms of the long-run benefits and the overall cost reductions of their day-to-day business operations, the decrease in human errors and the increased customer satisfaction. Due to limitations of time for semi-structured interviews, it was not possible to know about each and every technology that the organizations were using (1:38; 2.16) but authors were able to get some insights of some of the most significantly used technologies.

The table below shows some of the popular technologies among these organizations, their frequency in the interviews and the number of times these technologies are referenced with performed interviews.

Table 3.1 Intelligent logistics technologies used by respondents organizations

Technology	**Number of mentions**	**Organizations mentioned**	**References**
AGV	3	R1, R5, R6	6
AI (Artificial Intelligence)	4	R2, R3, R5, R6	8
BD (Big Data)	4	R2, R4, R5, R6	18
CC (Cloud Computing)	5	R2, R3, R4, R5, R6	5
IoT (Internet of Thing)	3	R2, R5, R6	10
Ro (Robots)	5	R1, R3, R4, R5, R6	12
SW (Smart Warehouse)	6	R1, R2, R3, R4, R5, R6	15
OT (Other Technologies)	5	R1, R2, R3, R5, R6	15

According to table 4.1, Out of all the technologies discussed in the literature review, the technology that every respondent organization mentioned in their interview was smart warehouses. The second most used technology was robotics for unmanned picking, sorting and distribution of merchandise. Other than that, the technologies most commonly used and referred to in interviews were big data, IoT, AI, cloud computing and AGV respectively. The category other technologies (OT) include those technologies which are not mentioned in our literature study. This includes those intelligent information systems that are specific to a par-

ticular respondent organization and is tailored by keeping in consideration of their own business needs. Other than that, the use of barcodes and QR codes was also found very common in these organizations which are also placed in the OT category.

In order to provide a more structural view of these technologies, we divided these technologies into two categories in our derived theoretical framework. One refers towards a more hardware aspect of technologies which includes robots, stacker cranes, drones AGV and smart warehouses with the name Robots while the other technology focusing more on software and internet related technologies like IoT, cloud computing, big data etc., with the name of category AI. Our finding will highlight both in much detail as following:

4.4.1 Robots

When the respondents were asked about the role of intelligent logistics in their organization, almost all the respondents showed heavy reliance on their logistics to keep their business function efficiently. For this purpose, they are now making use of different types of advanced technologies.

R1 while talking about this shift towards intelligent logistics elaborated that.

"In the early days it was manual picking, and a warehouse could only pick up to 20-30,000 pieces a day. That's 5% of our current volume now. Later on, more and more people were shopping online, and the volume of orders increased. It would certainly not have been possible to rely on manual picking alone. We then started using robots for sorting so that we could sort 24 hours a day. And with this Covid-19 outbreak, many logistics industries that rely on manual picking have suspended their operations. JD Logistics' unmanned intelligent warehouses are a good example of its advantages" (1.28).

The use of robotics leads towards the formation of unmanned intelligent logistic warehouses which completely changed the business scenario with its ability to efficiently deliver orders to customers within 24 hours. Unlike the traditional warehouses where the logistic workers perform the task of picking and sorting orders, it is now all done by robots (1.30). This use of unmanned intelligent warehouses has decreased the human error factor significantly, eventually leading towards reduced complaints and increased satisfaction (1.34). This automatic picking can be performed 24 hours a day with a 99% of correct rate (1.36).

In intelligent warehouses all the packaged goods are bar coded and entered in this system for efficient sorting, picking, transporting, and tracking these items (1.34). R2 organizations are also using the bar code technology for their daily operations of shipping goods (2.34). R5 also showed coherence with R1 and R2, by incorporating barcode digital technology by mentioning:

"In 2014 we started using smart barcodes. Each parcel is given a unique ID card and can be tracked in real time. And our smart barcodes unify various data standards. This allows the system to map out the delivery route when the order is generated, and picking and delivery can be arranged in advance" (5.38).

R6 organization Amazon, in addition to other AI algorithms, are also using QR codes to configure each item, each QR code represents ID card stock location to find out where the item is located, therefore, enabling a precise location of the global stock (6.60).

R2, being representative of a food retail company explained how fast delivery is a critical factor of their business which makes the logistic requirement quite stringent due to their timeliness in delivery and shorter shelf life (2.24). The option to deliver within 30 minutes to its customer (2.10), is highly rated by the customer and provides a competitive edge to the organization because of their efficient and high quality of delivery (2.12;2.14). With the help of intelligent warehouses, they can track and monitor inventory within real-time (2.32), can efficiently locate and dispatch orders and can also move between different types of work with the help of robots (2.32).

Unlike R2, R3 belongs to one of the giant electronic appliance retail organization, even from being an entirely different retail business domain, they also showed heavy reliance on unmanned intelligent logistic warehouse for their day-to-day business operations which showed that intelligent warehouses are proving beneficial for almost all the retail businesses irrespective of their business nature. While talking about the usage of intelligent logistic technologies, he added,

"Let me tell you about our intelligent warehouse, the unmanned warehouse technology. We have piloted unmanned warehouses in two cities with high order volumes and major transport hubs. In total, we are equipped with more than a hundred intelligent robots. From the traditional logistics model of "people looking for goods" to the intelligent era of "goods looking for people". The traditional mode of picking goods in logistics warehouses is called "people looking for goods", which requires a high level of professionalism and proficiency from the sorting staff. This requires staff to know exactly where to place each item. But now all our items have their own unique code. And we record all this information in our intelligent logistics system. The robots are programmed to move the shelves to the designated locations, enabling unmanned 24-hour working mode" (3.26)

R4 mentioned how an intelligent warehouse helps their grocery retail business to effectively manage their logistic volume. While talking about their current project of "life warehouse" which is also a significant part of their intelligent logistics, he said:

(…) In terms of storage hardware, the intelligent warehouse has a full temperature zone storage environment including room temperature, refrigerated and frozen, and the goods inside can meet the daily consumption needs of the young urban population and families (4.22).

While highlighting the role of robotics in performing their daily business operations, he further said:

"Intelligent picking is currently being implemented in some of our warehouses… The commissioning of these picking robots, automatic sorting lines and other intelligent equipment has further reduced labour costs and improved the efficiency of distribution in our intelligent logistics centre. The average picking efficiency of the robots is 153 rows per hour, more than three times that of manual picking. The robots also have a daily shipping capacity of 5,000-7,000 order lines, which can easily solve the shipping needs of shops and warehouses. Another advantage of robotic picking is lower picking error rates, longer working hours and less effort in site management. This allows us to reduce the number of staff on site and achieve cost reductions and efficiencies" (4.26).

But contrary to all the rest of the respondents R4 showed a little dissatisfaction with robotic sorting in terms of their business nature, he elaborated further that robotic sorting is excellent

in everyday goods (4.46) like household appliances, daily goods and mainly goods (4.48) but has it certain limitation with fresh goods. Explaining further he said:

"The most unusual thing about fresh produce is that it can be perishable and defective. Of course, this can happen with other products too, but it is more common in fresh produce. For example, if an apple is rotten with a hole in it, an intelligent robot cannot recognise the hole and it knows to take the bag of apples. *But the manual sorting will be able to weed it out very well. So, this is one area where we are not happy with robot sorting" (4.50).*

R5 said that it is the main vision of their company to build an intelligent logistics network throughout the world to help the logistics industry move towards high-efficiency, low-consumption intelligent logistics and improve the quality of logistics services (5.10). With the help of these intelligent logistics networks, they are able to achieve 24-hour delivery in China and 72-hour delivery worldwide (5.28).

R6 mentioned that the intelligent warehouses of amazon consist of various technologies like robotics, big data, smart warehouses and many more. While elaborating further about robotics he said they acquired Kiva Systems in 2012 for $775 million (1.34)

"Following our acquisition of the Kiva robotics technology, we started by deploying 15,000 robots in 10 Amazon logistics centres in the US from the end of 2013-2014. We then deployed KIVA to *its transit centres around the world. As of 2016, we have deployed more than 30,000 Kiva robots in its 13 logistics centres around the world. With the help of the robots, Amazon has been able to save one hour per order processed, reduce pick-up-to-shipment time from taking one and a half hours to 15 minutes, and save approximately $900 million in labour costs annually. 2016 saw KIVA officially renamed Amazon Robotics in an attempt to create a new robotics platform. In addition to developing new AGV robots, it will also work to develop advanced robots that can handle complex aspects such as packing and picking, ultimately achieving the goal of unmanned warehousing" (6.36)*

These kiva robots help in picking the packaged goods and loading it onto trucks that are destined to different areas. These robots can automatically find the goods from the corresponding shelves with the help of received order information which are then loaded onto different lorries by these robots along with the capability to plan their route automatically around the 125,000 square foot site and load the goods onto the corresponding 300+ trucks (6.38). When asked how these robots can plan their route automatically within the warehouse of this huge size, the R further elaborated:

"First, we equip the robots with a cloud-based route control system. The control system is like a railway scheduling centre, which needs to arrange the route of each robot for each job, and also needs to monitor the *entire transport network in real time, for example when there is an accident. In the event of a traffic jam, a record is also generated in time to ensure the system performs properly. In addition, these robots have their own "blind" wayfinding. If you have the opportunity to visit our sorting centre, you will think that the floor looks just like a normal concrete floor. But if you look closely, you can see that the floor is covered with QR codes. These QR codes are the robot's "blind alley". Whenever the robot reaches a spot with a QR code, it scans it with a scanner "under the belly". The QR code also tells the robot whether it should "keep going" or "bend left/right" next. Once instructed, the robot will follow the instructions until it encounters the QR code that tells it it has "reached the end of the line". Once the robot has transported the goods to the different end points, the robot feeds the*

goods through the tracks into the chutes at the end points and the goods fall down the chutes into the lorries bound for the different areas. The sorting of the goods by the robot is then complete" (6.40).

The above finding clearly indicates the shifted trend of using unmanned intelligent logistic warehouses from traditional manual warehouses as all the respondent's organizations are now gaining huge benefits from this intelligent logistics technological shift. Other technologies mentioned by these respondents were AGV or stacker cranes or drones etc.,

R1 mentioned how the stacker cranes is making significant differentiation in performing their business operations by saying:

"The stacker crane is able to move goods horizontally or vertically on the shelves by lifting and telescoping the forks, which makes it possible to move freely and pick up goods in narrow aisles. This allows us to place the racks more compactly and increase the capacity of our warehouse. Furthermore, the high lifting capacity of the stacker crane makes it easy to lift heavy loads that can be in the warehouse in no time at all. And in our No. 1 warehouse in Asia, the stacker crane can be automated without manual control during operation, greatly increasing the efficiency of logistics operations" (1.42).

R5 while mentioning the usage of cutting-edge technologies in their organization mention the use of AGV unmanned vehicles and intelligent voice assistance (5.34). He further elaborated.

"AGV is a technology used in our smart warehouses for picking small and medium-sized goods. In the warehouse we use a matrix of AGV robots, which can work together to fulfil an order or perform different picking tasks on their own. When the robots are low on power, they recharge themselves at a charging station. For picking we use robotic arms that can operate in 360 degrees. Not only that, but each parcel has an intelligent barcode on it as an "ID card", ensuring that the goods can find their corresponding location on their own, saving a lot of time. We have tested that pickers in traditional warehouses walk up to 28,000 steps in 8 hours and pick 1,500 items. However, in the smart warehouse, the picker only takes 1,500 steps in a day and picks up to 3,000 items. You can calculate how much more efficient that is" (5.36).

He further mentioned that our intelligent warehouse is not 100 % human free and still needs to be operated by a combination of humans and machines (5.44).

Here it is important to mention that intelligent warehouses are not only the product of robots and other hardware technologies, but they are relying heavily on deep learning algorithms of artificial intelligence which will be discussed in detail under the section of AI of this chapter. So therefore, it is the integrated usage of different advanced technologies that combines to add significant benefits to the overall business growth and expansion.

4.4.2 AI

The AI category of our theoretical framework includes the technology related to the software related technologies of intelligent logistics. R2 organizations have developed applications for customers to browse their products online before going to physical shops to experience them. In the physical shops, these customers are guided to register as member, download the application and pay eventually Afterwards, consumers have the option to place orders directly on

the APP and have them delivered by a delivery person at their door or go to the physical shops to experience consumption and enjoy after-sales services such as no-reason returns (2.18). All this is possible with the help of big data centres to maintain members' profiles to get a better grasp of their choices and individual purchases and intentions (2.18).

With the help of using advanced technologies, their online business has the same turn over as their offline business (2.20). R2 further emphasized that being a retailer in the food industry, their business model is quite different from other retailers. He said:

"We have much higher requirements for timeliness and stock levels than other retailers. As most of our fresh food products have a short shelf life, we are keen to achieve 'zero inventory' through the use of artificial *intelligence and big data" (2.24).*

With the help of deep learning algorithms of AI and big data they are able to grasp the needs and preferences of consumer demands by analysing user consumption data, backstage browsing records, and transaction records. They are also able to make personalized recommendations to users through apps and SMS. This data analysis also helps them to accurately make predictions for inventory to keep it under control and to control operating cost effectively (2.24).

The concept to achieve zero inventory is also popular in R6 organization Amazon, and for this purpose they have built a global distribution and transportation network to analytically predict advance allocation for warehouses and to accurately forecast stock requirement with the help of big data analysis (6.56).

Apart from AI and Big Data, R2 also mentions the use of cloud computing technology for predictive analysis of consumers and their current logistics requirements.

R2 organization focuses on a decentralization approach which leads to a direct sourcing model i.e., delivering directly from suppliers to shops instead of moving them to the warehouse as this extra step of transportation cut down huge logistic cost, especially the goods with shorter shelf life like cold chain food, flowers and fruits are extremely susceptible to damage. With the help of big data algorithms to find the most suitable routes for delivery vehicles, these goods are directly shipped to shops from suppliers with the help of minimum vehicles (2.28). Where the physical shops play the role of logistic centres at the same time (2.32). Unlike the organization of R2, R4 being a grocery chain retailer make use of their intelligent warehouse instead of making their shops logistic centres (4.22) so all the deliveries are performed between the intelligent warehouse and supply chain. These intelligent warehouses have the capability to cover the distribution service to a surrounding area of about 3 km (4.22).

In order to facilitate online orders delivery effectively in a large area, the organization of R2 is using the intelligent Fulfilment Order Collection algorithm (2.30). Explaining further he said:

"This is based on our user delivery address database and allows our AI algorithm to calculate the most appropriate route, time sequence*, temperature layer, etc. Previously, retailers in the food industry had a one-to-one service. That is, one delivery person would travel to deliver one order at a time. But we can now deliver 2-3 orders at a time with one delivery person based on big data algorithms. This saves us a lot of money in logistics costs and increases our timeliness" (2.30).*

This intelligent system for ordering stock allocation helps them to achieve zero inventory. Through intelligent forecasts for the allocation of goods to different regions. This is achieved by scrutinising the number of users clicks there are in the area and percentage of page jumps to deals. After that back-end data calculations are performed with constant iterations, constant optimisations to reach intelligent stock allocation (2.38).

The R2 organization is further looking forward to improving the use of IoT technologies to provide better quality transportation and reduce unnecessary waste(2.50). R6 also mentioned the significance of using IoT for cold chain control, transport security, route optimization (6.50). by further explaining the role of IoT technology he said:

"(…) We collect driver and vehicle status data through our devices to detect driver fatigue and vehicle overloading and speeding in time. And we monitor whether the vehicle route is following the established route. If the position is shifted, we will contact the driver in time. And we will use the information collection equipment installed on the vehicle, which can collect information on the condition of the transport vehicle, road conditions, weather and so on. This information will be uploaded to the information centre and analysed to optimize the dispatch of the vehicle" (6.52).

For R3, logistics plays a highly critical role for their business, for this purpose they have set up their own logistics subsidiary (3.22). The technologies used by R3 are more or less the same as R2 but unlike the organization of R2, they have a centralized model for distribution strategy as these companies belong to an entirely different domain of electronic appliances industry (3.24). While talking about their centralized warehouse, he said:

"(..) When a customer purchases a large appliance, it is centrally distributed from the main warehouse, but this requires the shop to know exactly what is in stock and the distribution centre to know what is being delivered to where and when. We use cloud computing analysis in the background to integrate *customer delivery information. We plan a reasonable route and delivery time, so that one vehicle can deliver 3-4 orders. This greatly improves our delivery efficiency" (3.24).*

R4 organizations have their own order management system (OMS) to form a unified management platform for orders, inventory, visualisation, and other data. This allows them to achieve unified management of customer orders across multiple channels, both online and offline and help them to build a unified logistics database with functions such as monitoring overall order pools, inventory centres and supply chain planning and performing a collaborative forecast. It also facilitates them to analyse warehouses and the rationing of our merchandise inventory (4.24). The usage of advanced technologies like IoT, Cloud Computing and Big Data helps them to improve interaction between customers, dispatchers, carriers, drivers, and shops therefore significantly reducing manual communication costs. For example, customers can see the location information of couriers in real time and know the delivery status of their orders as well as the suppliers can also get inventory information in real time and these deliveries can be prepared in advance (4.24). This intelligent logistic management system is further integrated with the resource planning business data to calculate the logistic cost effectively. Through this application of the intelligent logistics platform, a clear picture of logistic overhead of each segment can be provided and the overall efficiency and service quality of the logistics supply chain can be improved (4.22).

When asked about the high ratings of customers for their organization as compared to other retailer, R4 gave credit to the usage of modern technologies by saying:

"The high customer ratings are due to the fact that our company's logistics delivery is superior to that of other shops. Our intelligent *logistics has features such as fast delivery and low breakage rate of goods …our intelligent logistics delivery business is completely autonomous, with data and identifiability of member information at its core. This can be reflected in our app. The percentage of class-identified members in our retail shops has reached 80%, which is a very significant achievement compared to our peers" (4.30).*

R5 while talking about their company Cainiao Logistics mentions how their organization with the help of using modern internet technologies like IoT, Big data and cloud computing will help to create difference from traditional logistics by elaborating.

"(…) advanced internet technology will be used to establish a shared data application platform. To provide quality services for e-retailers, third party logistics service providers, suppliers, and other types of enterprises. To help the logistics industry move towards high-efficiency, low-consumption intelligent logistics and improve the quality of logistics services. Our intelligent logistics system will integrate the *data of production and circulation to achieve high-speed information flow and real-time sharing. This will minimise the flow of goods, improve logistics efficiency and reduce costs. We hope that this new intelligent logistics operation mode can overturn the traditional logistics mode of the past" (5.10).*

R5 also mentioned how much the acquisition of real-time data is significant to bring life to deep learning AI algorithms; therefore, IoT technology is incredibly important in Cainiao's smart logistics strategy to re- engineer the traditional logistic systems (5.30). With IoT strategy, they continue to make our logistics systems intelligent and digital by further explaining that

"The year before last (2019), we officially launched the Smart Logistics IoT open platform, which enables us to connect any device into it. For example, when a logistics warehouse is connected to the platform, the warehouse itself becomes digital. It can be freely dispatched by the user, with an extremely high level of intelligence. The platform system is also able to tailor planning algorithms and assign tasks to workers based on stock and order volumes" (5.34).

R5 showed great satisfaction with the use of intelligent logistic and big data algorithms as it has really improved the efficiency of overall logistics by mentioning *"The average logistics reach days have now been reduced by 0.8 days. As our smart logistics becomes more popular in more cities, this efficiency will get higher and higher" (5.48).*

The R6 department is mainly responsible for big data analysis on Amazon. Just like R2, R4 and R5, their organization is also making use of big data to capture user purchase history and browsing data, this data is further used for predictive analysis to update current warehouse management, for planning stock and also to rationalize the number of intelligent robots (6.10).

While talking about Amazon Intelligent Logistics System and its robot path algorithm, he further explained how this algorithm functions by saying:

"In order to understand how many robots are placed at a time and at what speed setting the whole sorting system is most efficient, *we have a special simulation system. With the help of*

the simulation system, it is possible to analyse more intuitively how best to configure robots for different order volumes or more complex conditions. And this planning process is supported by big data. Logistics operations driven by intelligent algorithms can ensure optimal paths because a set of data algorithms in the background will randomly optimize the paths of the robots based on their picking, and the system will automatically recommend an optimal picking path to the picker to avoid backtracking and ensure that it has the shortest path after picking" (6.46).

All these findings highlight the role of intelligent logistic technologies as a game changer for all the interviewed organizations that have significantly played a vital role in recent years to manage the huge logistic volume of retailers efficiently.

4.5 Outcomes of intelligent logistics

Intelligent logistics technology brings benefits as well as challenges to retail organisations. Based on the analysis of the previous literature review, we mapped the5 content presented by the respondents with the levels of our derived theoretical framework. This resulted in the following areas.

4.5.1 Benefits

Intelligent logistics offers retail companies a great deal of benefits and, based on information from six interviews with respondents, we have grouped the benefits into the following three directions: time, quality and cost. In each subsection, we analysed the changes in the organisations and the benefits gained before and after the use of intelligent logistics. As mentioned earlier, organisation, such as R2, have not made the transition from traditional to intelligent logistics. In turn, we will directly analyse its experiences and advantages in using intelligent logistics.

- **Timeliness Increased**

Timeliness was one of the first benefits of Intelligent logistics to be mentioned by Interviewees. The most obvious advantage is the increased speed of sorting and delivery (1.28, 3.28, 4.24, 5.26,5.36, 6.54).

R1 said that Intelligent logistics' robotics enabled them to sort goods 24 hours a day. Compared to the past, they have increased their picking volume by a factor of 20 and the manual picking of traditional logistics is no longer able to meet this demand (1.28).

"We then started using robots for sorting so that we could sort 24 hours a day. And with this Covid-19 outbreak, many logistics industries that rely on manual picking have suspended their operations. JD Logistics' unmanned intelligent warehouses are a good example of its advantages." (1.28).

Robotics and unmanned smart warehouses for intelligent logistics have another time-sensitive feature. As well as being able to work 24 hours a day, they can also respond to unexpected situations and thus not delay logistics picking. R1 said that many logistics organisations that rely on manual sorting have been forced to suspend operations during the exceptional period of the

global epidemic. However, thanks to unmanned smart warehouse technology, R1's retail organisation was able to carry out normal logistics operations while meeting government requirements for quarantine limits on numbers.

"(...) Each of our products is identified by a corresponding label. The goods are barcoded and the barcodes are entered into the system so that the goods can be accurately identified and sorted. And we can pick an average of 12,000 items per hour, which is much more efficient" (1.34)

R3 refers to data on the specific timeliness by Intelligent logistics.

"(...) But from our practical "intelligent warehouse" after the robot picking efficiency compared to the average manual increase of nearly 270%, handling time overall shortened by nearly 30%. Yesterday's figures, for example, showed that in 12 hours, we were able to pick more than 34,500 items, which greatly improved our logistics picking efficiency." (3.28).

Sorting efficiency has increased by 270% and handling times have been reduced by 30%. This is all part of the huge timeliness improvement brought about by Intelligent logistics.

R4 said that a well-located warehouse and a reasonable ratio of stock would enable goods to be delivered to customers more quickly (4.22). To achieve this, R4 uses Intelligent logistics technology to create a logistics database that can be used to select the right warehouse location and rationalize the allocation of stock.

In R5's smart warehouse, the efficiency of picking has improved from pickers taking 28,000 steps and picking 1,500 items in eight hours to taking 1,500 steps and picking 3,000 items, an almost 20-fold increase.

"(...) each parcel has an intelligent barcode on it as an "ID card", ensuring that the goods can find their corresponding location on their own, saving a lot of time. We have tested that pickers in traditional warehouses walk up to 28,000 steps in 8 hours and pick 1,500 items. However, in the smart warehouse, the picker only takes 1,500 steps in a day and picks up to 3,000 items. You can calculate how much more efficient that is." (5.36).

R5 also mentioned:

"*The current smart warehouses and big data algorithms have really improved the efficiency of our logistics. The average logistics reach days have now been reduced by 0.8 days. As our Intelligent logistics becomes more popular in more cities, this efficiency will get higher and higher." (5.48).*

And the average logistics delivery days per item has been reduced by 0.8 days, which is a huge timeliness improvement based on the volume of logistics per year as previously estimated by R5. R6 mentioned the same point as R1, that Intelligent logistics technology allows e-retailers to pick and pack goods 24 hours a day.

"(...) Our Kiva robots, for example, are six times more efficient than manual picking and can work in shifts 24 hours a day, something that the traditional logistics industry cannot do." (6.54).

- **Quality Improvement**

The most mentioned aspect in terms of quality is the improved correctness of sorting (1.36, 3.28). Also, other respondents mentioned the ease of updating logistics information in real time and the rationalization of stock (4.24,6.54).

"The most obvious is the improvement in correctness and efficiency. Our unmanned warehouse, for example, has an automated picking system that can achieve a 99% correct rate. This is much better than manual picking." (1.36)

In addition to R1, R3 also mentioned that intelligent logistics has improved the correctness of goods sorting.

"(...) Previously we had to rely on logistics staff to find the goods themselves and use forklifts to move them. But this was a much less efficient way of working and there were inevitable mistakes made by staff during transport. The situation of picking up the wrong goods, goods damage will also occasionally happen." (3.28).

But in addition to the correct picking rate mentioned by R1, R3 also mentioned the robotics of intelligent logistics helping logistics workers to transport goods better and more safely (3.28).

R4 and R6 talk about the quality improvement of intelligent logistics from an inventory perspective (4.24, 6.54).

"*At the transport level, (...) customers can see the location information of our couriers in real time and know the delivery status of their orders. Our suppliers can also get our inventory in real time. We can prepare for deliveries in advance." (4.24)*

The real-time information data update function of Intelligent logistics allows retailers to have a better overview of the inventory situation and to prepare in advance (4.24, 6.54).

"(...) And with our Intelligent logistics technology, we can adjust inventory levels to the lowest possible level and operate with zero inventory." (6.54).

- **Cost Reduction**

The reduction in logistics costs due to intelligent logistics is significant. Every respondent mentioned that intelligent logistics had reduced their logistics costs in different ways: speed and efficiency of picking (1.34); less damage and loss of goods (4.24); lower transport costs (2.30); and lower labour costs (5.48).

The organization represented by R1 says they are now able to pick an average of 12000 items per hour which leads to operations being very efficient and further reduces labour costs (1.34). R1 further states that as logistics costs have gone down in the long run. Their warehouses are operational for 24 hours, which reduces costs of many additional claims and exchanges (1.48). On being asked on how efficiency increases the cost savings for the organization, R1 answered as:

"(...) manual picking and a warehouse could only pick up to 20-30,000 pieces a day. That's 5% of the current volume"

Also, a large number of people are purchasing things online, which requires more emphasis on automated pickup of goods for customer satisfaction. Therefore, organizations are investing in robotic sorting, which has increased their sorting time to 24 hours a day (1.28). There has also been an increase in unmanned warehouses as they provide 99% efficiency and in the face of COVID-19, they help in providing a safe method of operation, which all combined, leads to a huge reduction in labour costs.

R2 says logistics intelligence implementation saves a lot of money in logistics and increases overall efficiency (2.30). there is significant reduction in their operating and logistics costs, which further increases their organization's revenue (2.40).

R3 states that there was not much increase in the profits which was noticeable (3.24). When asked about the efficiency related to intelligent logistics, R3 says:

"(...) "intelligent warehouse" after the robot picking efficiency compared to the average manual increase of nearly 270%, handling time overall shortened by nearly 30%"

R3 also informs that their organization's overall efficiency has gone noticeably high, but they do not have a very noticeable increase in profits (3.32).

R4 says that the implementation of intelligent logistics has given them the ability to calculate the cost of warehousing. This leads to reduction in logistic costs and increase in efficiency (4.24). On asking for a brief explanation for the cost reduction, R4 responds by saying:

"(…) with RP business data, we can calculate the cost of warehousing. This gives us a very clear picture of the logistics overheads for each segment" (4.24).

The organization represented by R5 says they were able to achieve cost reduction even while t global pandemic crisis (5.22). This shows the importance of logistics intelligence to the cost of the company and the user experience. R4 also states that logistic planning for practitioners can improve efficiency, reduce labour and logistics costs and reduce redundant effort, adding to the profits gained by the organization. For consumers, intelligent logistics improves their experience by precise on-demand and express fast delivery which adds to the future benefits experienced by the company (5.26). The current in use algorithms related to intelligent logistics have made the efficiency of the organization to go high (5.48). When asked to elaborate, R5 responded by saying:

"(...) the average logistics reach days have now been reduced by 0.8 days. As our intelligent logistics becomes more popular in more cities, this efficiency will get higher and higher." (5.48)

R5 also talks about how their smart warehouses are much more efficient with respect to the manual warehouses. As an example, R5 states:

"(...) pickers in traditional warehouses walk up to 28,000 steps in 8 hours and pick 1,500 items. However, in the smart warehouse, the picker only takes 1,500 steps in a day and picks up to 3,000 items" (5.48).

This gives a clear picture on how the efficiency has increased by using intelligent logistics in their organization and how well it affects the total gains received by the organization.

R6 says that their organization has gained $900 million in annual labour costs by deploying 30000 KIVA robots. The use of robots has reduced pick up to shipment time from 1.5 hours to 15 minutes. When asked about the details, R6 responded by saying:

"(...) Amazon has been able to save one hour per order processed, reduce pick-up-to-shipment time from taking one and a half hours to 15 minutes, and save approximately $900 million in labour costs annually." (6.24)

R6 further states that robots being used in their organization are six times more efficient than manual work and robots are operational 24 hours a day (6.54). Intelligent logistics technology also enables optimizing inventory to the lowest possible level and operates with zero inventory (6.54). The profits gained are used as investment for more robotic application which further adds to the company profit gains. This has led to reduction in the company's logistics investment which further improves annual profits.

4.5.2 Challenges

Intelligent logistics not only brings many benefits, but also many new challenges. The three advantages in terms of time, quality and cost mentioned in the previous chapter also bring with them a number of challenges. The most frequently mentioned challenge logistics costs. Every respondent mentioned, to a greater or lesser extent, the increase in R&D and logistics costs. At the same time, employee anxiety is also a factor that cannot be ignored. It is not only logistics workers who face challenges like unemployment, transition and training of new technologies, but also the management of the company is faced with the worry of a shortage of talent. Also mentioned in the literature review are security issues, such as customer privacy and machine and equipment safety. Based on the information provided by the respondents, we will analyse the challenges posed by intelligent logistics from the following three perspectives: cost, human resources and security.

- **Increased R&D Cost**

Although author talked about the reduction of logistics costs due to intelligent logistics in the subsection on benefits, the respondent also pointed out the cost incurred in research and development of intelligent logistics.

R1 offers a dialectical view by mentioning that In the years when their organization first invested in intelligent logistics, the logistics costs for companies were rising. But if the long-term economic effects are taken into account, the logistics costs are falling (1.50).

"*In recent years it has invested in a lot of research costs and the cost of warehouse renovation. This is far more than the benefits." (1.50).*

However, it is worth noticing that R1 is a major e-retail organization. For such organizations, the huge R&D and adaptation logistics costs are affordable, but for smaller companies this cost is still unaffordable. R1 also pointed out that intelligent logistics is the direction of development and an inevitable trend of future logistics. Even with high R&D costs, they will insist on the transformation (1.50).

Respondent R2 was from the retail organization that have used intelligent logistics from the start (2.42). Further mentioning, he said:

"Actually, the costs are not that significant. Because we are a relatively new company, we already knew about intelligent logistics systems at the beginning of our company." (2.42).

The use of intelligent logistics from the inception of the company allowed R2 to not have to pay for logistics modifications.

Contrary to that, R3 indicated that after using intelligent logistics, logistics R&D costs have increased and have even led to a drop in profitability:

"Efficiency is much higher, but our earnings have not changed very significantly. There was even a decline in profits in 2018, 2019." (3.32).

He further attributed the rise in logistics costs due to the following three factors: system maintenance costs for intelligent logistics; pre-development and purchase costs for robots; and post-development equipment maintenance costs (3.34).

R4 indicated that logistics costs have increased significantly due to factors such as the need to purchase equipment and build new information systems as a result of the transition from traditional logistics to intelligent logistics (4.16, 4.24, 4.38).

"*That's because it takes money to develop systems, buy robots and form new sorting processes. It's expensive to adapt a new intelligent logistics system. That's why we are gradually moving forward with intelligent logistics. It would be unrealistic to complete the entire transformation of intelligent logistics in a short period of time. The company's capital cannot afford to spend so much." (4.38).*

R4 also mentioned that they are gradually making the transition to intelligent logistics due to the high cost outlay in the process. This allows their company to keep the increase in logistics costs within acceptable limits.

R5 did not feel pressured by the increased costs associated with intelligent logistics. Instead R5 is more concerned with the profits that intelligent logistics can bring, such as the reduction of time costs and labour costs. But the amount of investment mentioned by R5 is still shocking, up to 100 billion (5.50). For an average retail organisation, this figure would certainly be very stressful or even impossible to achieve. So based on the information provided by R5, authors still feel that the investment costs for intelligent logistics are significant.

But for organisations like R2 that use an intelligent logistics system from the outset, the logistics costs can save a lot of money on retrofitting. So, for emerging start-ups, choosing intelligent logistics from the beginning may save even more on logistics costs.

Likewise, R5, R6 has made a huge investment in intelligent logistics technology. First they acquired the KIVA business

"(...) We spent billions of dollars to acquire Kiva Robotics." (6.72). And they are investing more and more "Following our acquisition of the Kiva robotics technology, we started by deploying 15,000 robots in 10 Amazon logistics centres in the US from the end of 2013-2014. We then deployed KIVA to its transit centres around the world. As of 2016, we have deployed more than 30,000 Kiva robots in its 13 logistics centres around the world (...)" (6.36).

They also want to do further research in new driverless technology by mentioning further:

"(...) what we do is use better algorithms and work on more new types of technology. In the future we will also develop self-driving technology to deliver goods faster and safer." (6.74).

R6's investment costs will continue to rise, but they did not express much concern during the interview, instead they are focusing on future savings in time, labour and other costs that comes by incurring this cost (6.72). Which differs here from R1, who did not give much thought to cost escalation as their company was much larger and more profitable than R4. Again, this was not mentioned in the content of the interviews respondent R5 and R6.

Correspondingly, smaller retail organizations would give more consideration to the factor of increased logistics costs. But for organizations like R2 that use an intelligent logistics system from the beginning, the logistics costs can save a lot of money on retrofitting. Therefore, for emerging start-ups, choosing intelligent logistics from the beginning may save even more on logistics costs.

- **Human Resources Shortage**

The issue of logistics workers was mentioned by all respondents during their interviews (1.58, 2.44, 3.28, 4.32, 5.42, 6.62). Some respondents also mentioned the pressure faced by employers in recruiting the right logistics talent and training logistics workers with new skills (4.54, 5.42, 6.66).

The pressures faced by employees were the most frequently cited, with all respondents mentioning the need for new skilled personnel in logistics and the need for transformation (1.58, 2.44, 3.28, 4.32, 5.42, 6.62). This means that employees need to acquire more new skills in order to adapt to the talent needs of intelligent logistics.

R1 directly pointed out that a switch in talent type is necessary (1.58).

"(...) As our future intelligent logistics continues to develop, traditional sorting talent can no longer meet the demand for intelligent warehousing talent. The most basic thing is to be able to use computer systems proficiently. So we need a lot of high quality talent."(1.60).

This means that traditional logistics workers have an employment crisis if they do not make the appropriate transformational changes and acquire new intelligent logistics skills, such as computer skills.

R2 has the lowest perception of employee stress of all respondents in relation to the logistics talent transition crisis. As R2 used an intelligent logistics system at the outset, they employed logistics staff with some knowledge of computer skills and were highly skilled logistics workers (2.44,2.46).

While R2 conveyed a more relaxed atmosphere, R3's answers conveyed a somewhat tense employment situation for logistics workers (3.42).

"*First of all, the system is replacing a lot of the physical activities of logistics workers. This is definitely something that makes it easier for them. But at the same time, it means that we have redundant labour. Many logistics workers face the risk of losing their jobs, and this will certainly give them anxiety." (3.42).*

While intelligent logistics has saved logistics workers time and convenience, it has also brought them anxiety about losing their jobs.

"(...) there is a high demand for high level labour. The demand for logistics workers who are engaged in manual labour will be lower and lower." (3.44).

The demand for logistics employees has also become polarized. At one end of the spectrum, there is a growing demand for highly skilled logistics employees, while at the other end, traditional logistics employees are facing a situation of being eliminated.

However, unlike the logistics employees in R3 who were anxious about losing their jobs, the employees in R4 were given the opportunity to be trained by the company (4.36).

"They were initially rejected. It was clear that many employees' jobs were threatened after we used robotic picking. (...)" (4.32)

Although the employees of R4 organization were also initially resistant to intelligent logistics, fearing that their positions would be replaced by robots and they would be at risk of losing their jobs. The next series of measures organized by R4 did well to help them through the crisis.

"*Our company conducts courses in computer competence training for logistics employees, machine operation training and theoretical training. Since logistics employees are generally less educated, they are less receptive to mechanised and intelligent logistics systems. What we have to do is not just to lay off staff, but to try to help them improve their abilities. (...)" (4.36)*

R4 has a range of training programmes for logistics staff to help them transform into the logistics talent required under a compliant intelligent logistics system.

The situation for R5 is somewhat similar to that of R2, but R5 has a higher degree of development. R5 indicated that their employees are technically skilled (5.42).

"(...) None of the thousands of employees are couriers, nor do we have a single logistics delivery vehicle. (...) More of our employees are algorithmics, programmers, etc., and some are mechanical and warehouse maintenance managers. A small number of them are auxiliary pickers in the warehouse." (5.42).

In the organization of respondent R5, we see a working model of the future of intelligent logistics where traditional logistics workers are replaced by robots, working in the logistics sector as senior algorithmics, programmers and other specialist technicians but this is still a huge challenge for traditional logisticians. For algorithmics and programmers, intelligent logistics systems are also a potential career path for them.

Unlike the rest of respondents, R6 provided a much positive feedback. Intelligent logistics tasks can help reduce the burden of logistics workers whereas he did not mention issues such as employee unemployment and skill transformation (6.62).

In summary, the biggest problem faced by logistics employees today is the loss of jobs to robots. But different companies have different strategies. Some take a slow transition approach,

others help logistics employees with technical training. Either way, employees are faced with the need to master new technologies.

Unlike employees who are anxious about losing their jobs, employers are under pressure to recruit new talent and to train traditional logistics staff (4.54; 5.42). In order to avoid repetition, we will not list here again the analysis of the needs of each in terms of employees. R4 repeatedly mentioned the training of logistics personnel as part of the employer's responsibilities (4.36).

- **Security Problem**

Although literature review findings revealed that intelligent logistics may also raises some security issues such as customer privacy and security of use of intelligent logistics devices (Johnston, 2018, Humphries, 2018). However, none of the respondents explicitly mentioned any security issues throughout the interviews.

5 Discussions

This section presents the discussion of our research based on the similarities and differences we found between our literature review and our findings through our semi-structured interviews. The main themes of this chapter is aligned with our derived theoretical framework of section 2.5 from our literature review which is also similar to the analysis chapter to keep our discussion more aligned and structured. This chapter provides an insight of what we find through this research.

5.1 External triggers

With reference to our derived theoretical framework of section 2.5, it was apparent that certain factors play the role of external triggers to make a shift towards intelligent logistics technologies. These external triggers were the changed behaviour and demands from customers, the changing scenario in the business landscape where the competitors operate and last and other environmental factors that are unavoidable to overlook if the organization wants to keep functioning efficiently (Section 2.5). Following are some of the significant findings from our literature study as well as interviews with respect to these external triggers.

It was inferred from the findings of literature that the behaviour of customer has been significantly changed over the years due to intensive use of ICT (information & communication technologies) in their daily lives, which has resulted significant transition in the retail sector as well, making it an even more dynamic sector (Priporas et al., 2017). Especially after the pandemic of covid-19, the retail sector has taken a dramatic turn with the rapidly changing behaviour of customers (Bitner et al., 2002; Demirkan & Spohrer, 2014; Shankar et al., 2021).

From our interviews, the respondent also mentioned this change in the behaviour of customers, especially the increase in the number of online orders after the pandemic (1.28; 6.18).

Almost all the respondents mention great customer satisfaction and highly positive feedback after embracing intelligent logistics (2.14 ;3.38;4.18;6.20;1.14; 5.40). On the other hand, none of the respondents reported any dissatisfaction from the customer's end after shifting towards intelligent logistics. These findings were aligned with the findings of our literature study according to which intelligent logistics makes a positive influence on customer satisfaction and customer retention (Schramm-Klein & Morschett, 2006).

R3 and R5 mentioned a drop in customer complaints by 40% and 30% respectively by using intelligent logistics (5.22; 3.38) and R6 also mentioned that rarely any complaints have been received from customer after shifting towards intelligent system (6.22) which has ultimately helped to reduce the overall logistic cost in terms of additional claims and exchanges etc. (1.48;1.34). These results seem quite aligned with our findings from literature when Davis-Sramek, Mentzer and stank in their research in 2018 concluded customer service as the main driver of price, quality, variety, and delivery speed. R5 also mentioned the speed of delivery and the quality of logistics as a critical factor in customer satisfaction.

Business landscape referred to another external trigger that made this shift towards intelligent logistic inevitable (Winkelhaus & Grosse, 2020). Throughout our literature findings, it was

obvious that the dynamic changes in the needs of retail organization along with the current demands of time made this shift of intelligent logistics even more necessary (Section 2.3.1). The interview findings seem well aligned with the literature findings where respondents mention how the growth of their business volume and the changing trends of shopping to and multiple channels made them use intelligent logistics technologies (2.20;1.7; 3.40; 4.6;6.14).

The environmental factors and sustainable approach have already gained lots of attraction from researchers as well as the practitioners of retail industry and it has now become a hot topic over the years consequently making it the thirds most significant external triggers for the evolution of intelligent logistics over the years (Figure 2.2). From our literature findings as well as the interviews findings, it was deduced that the organizations are much willing to strive for becoming greener and more sustainable. Literature reveals that the main driver behind this green logistics comes from various factors which includes corporate social responsibility, customer awareness and a need to demonstrate to both customers as well as other stakeholders involved (Mckinnon & Edward, 2018). With reference to this, R5 already mentioned that many multinational companies are already been using their environmentally friendly delivery boxes on large scale whereas R2 also mentioned that they want to enhance the quality of their transport as well as reduction of unnecessary waste in future (2.50) which shows the increased awareness as well as willingness to strive for green solutions.

Literature finding even revealed that sustainability is a part of some of the definitions provided for intelligent logistics e.g. according to Hutchison and Mitchell in 2018, Intelligent Logistics should provide maximum profit to the suppliers as well as best service to the consumer, at the same time it should also consume the least amount of natural and social resources and protect the ecological environment to the maximum extent, thus forming a complete intelligent social logistics management system. With reference to this approach, R2 also mentioned that they want to work extremely hard to promote sustainable logistics methods in future (2.48) which indicates the increased pressure from other peers in terms of environmentally friendly approaches.

Literature findings also reveals the acknowledgement of sustainable metrics in retail supply chain in terms of reduced packaging, alternatives of fuels and carbon footprints Wiese et al. (2012).This seems aligned with our findings as R2 mentioned they wants to improve cold chain truck temperature monitoring technology to reduce carbon emissions while ensuring the quality of fresh produce (2.52) Whereas, R6 organization also showed an interest to move towards low carbon transport by taking advantage from solar power, electric vehicles and other means of transport (6.78). On the other hand, R5, also mentioned that their organization Alibaba has already being committed in promoting green logistics through specific metrics like green parcels, green recycling, green intelligence and green delivery (5.54)

5.2 Internal triggers

In recent years' logistics has also influenced the development of retail businesses from internal factors. According to the respondent' descriptions, the increasing volume of goods (1.16), the different types of retail organisations have different needs for logistics and different logistics costs (3.16). At the same time logistics benefits are becoming more and more important in the development of companies (5.14). According to the literature review (2.2.2), logistics not

only plays an important role in operational efficiency, but also generates profits and supports market expansion (Kihlén, 2007, Abrahamsson & Rehme, 2010).

In the interviews, the respondents all expressed an increase in the volume of goods, (1.16; 2.12; 3.18; 4.10; 5.16; 6.18) and the need for intelligent logistics technology to support their expanding business (1.20; 2.22; 3.18; 4.20; 5.10; 6.16). As stated in the literature review, research on logistics must go beyond the surface of logistics and integrate logistics with the overall business growth and strategy of the company (Schramm-Klein & Morschett, 2006). R5 organization was the most prominent of all respondents in terms of its impact of Intelligent logistics on the retail organisation as a whole and even on the logistics industry as a whole (5.26).

5.3 Intelligent logistic technologies

With the help of this research, authors made an attempt to explore which technologies of intelligent logistics are highly popular among retail organizations to bring benefits to the business and to create differences in terms of efficiency and business growth. For this purpose, authors made comparison of the most relevant existing literature and findings through conducting interviews with some of the most popular retail organizations across the world. These findings are as under:

Although in literature, there was no unanimously accepted definition of the concept of intelligent logistics, but our findings seem to be aligned with the most accepted definition of literature which was provided by Mcfarlane et al in 2016 as the planning, execution, monitoring, and control of logistics operation a more intelligent way compared to conventional solutions. The level of intelligence may vary among different applications and methods like product tracking and environmental sensing, problem recognition and automatic decision making and execution. Likewise, in our interviews, every respondent mentioned the inefficiency of traditional systems to handle their huge logistic volume which was rectified by using the intelligent logistic technologies (3.28; 4.42; 6.54; 1.34; 5.28). After using these technologies, every organization experienced higher efficiency to handle the huge volume of orders in millions of pieces everyday (1.36; 3.12; 4.10; 6.18; 1.10; 2.12; 5.16) with reduced errors (1.34) and great customer satisfaction through speedy deliveries (within 24 hours and within 30 minutes in case of food retail) (2.13; 5.28).

From our literature review, it was inferred that IoT is the main application of intelligent logistics with 45% of the literature articulating about it along with RFID and QR codes technologies. On the other hand, in our interviews only three out of six respondents mentioned IoT who were R2, R5 and R6 who referred to them 10 times making it the second most referred technology in interviewees (table 4.1). However, big data technology being referred 18 times by four of our respondents R2, R4, R5, R6 (Table 4.1), was found to be the most significant technologies under the category of AI of our theoretical model through our findings.

There was very limited literature found for the technologies like smart warehouse, robotics, stacker cranes, drones and AGV, as most of the literature focused mainly on different types of strategies to support technologies implementations (Dong et al., 2021; Fligstein et al., 1990; Kihlén, 2007; Lohman et al., 2004; Schramm-Klein & Morschett, 2006). However, it was very astonishing to discover that technologies like smart warehouse and robotics were highly

popular among almost every respondent organization (Table 4.1). This indicates a noticeable research gap of researchers to investigate more into these technologies academically. It was also very unexpected to know that none of our respondents mentioned block chain technology which was the top game changer technology in the logistic industry in 2018 according to the literature findings.

Almost all the retail organizations being interviewed for this thesis were operating on a large scale. With most of them being the leading retailers of industry (Amazon, Alibaba, Jingdong and others) with many chains operating all around the world, it was not possible through our limited time span interviews to get full insight of every technology they have deployed. For this purpose, this research includes only the most significant and most popular technologies of their organizations. Here it is important to mention that every organization is still in process to embrace the intelligent logistic in an even more intelligent manner as they all mention where they would like to work further to extract even more benefits from these technologies (2.48; 3.36; 5.44). Although the use of unmanned intelligent warehouses and robotics have made a significant difference in their day to day operations, they still find a need to have a globally accessible unified logistic information platform where they can access the information of suppliers but not every supplier is on intelligent logistics platform yet (1.60; 2.54; 3.48). Almost all the respondents showed great interest in introducing new technologies to their organizations (4.52; 5.44; 6.52).

5.4 Outcomes of intelligent logistics

In the analysis chapter we discuss in detail the benefits and challenges brought by Intelligent logistics. Based on the findings of the literature review, we have divided the discussion into two parts: benefits and challenges.

5.4.1 Benefits

The benefits of intelligent logistics mentioned by the respondents are broadly in line with the research in the literature review. Respondents mentioned a reduction in logistics costs (2.30), an increase in warehouse utilisation (6.54) and an increase in efficiency (5.48). However, there are also elements that were not identified in the literature review, such as improved timeliness.

There is no doubt that both the respondents and the literature review provided a positive view on the reduction of logistics costs: robotics can perform simple repetitive logistics tasks using less labour (Kruger et al., 2009). R1, R3, R4, R5, and R6 all support this view (1.34, 3.32, 4.24, 5.26, 6.54). Of these, R1 mentioned that robotic picking and unmanned warehouse technology helped them to be able to carry out their logistics operations properly in the event of a global covid-19 epidemic (1.28). This nicely supports the fact that one of the advantages of intelligent logistics mentioned in the literature review is its application in extreme conditions (Karabegovic et al., 2015).

In addition to the reduction in logistics costs, benefits of smart warehousing mentioned by the respondents are similar to the findings in the literature review. The optimisation of inventory has led to a significant reduction in warehouse costs (Dinu, 2021), as evidenced by R2 and R4

and R6 (2.28, 4.24, 6.54). It is worth noticing that R2 and R4, who both own fresh food businesses, are more interested in warehouse optimisation techniques in smart warehouses, which they constantly emphasized as an effective way of reducing wastage and saving costs for fresh food (2.28, 4.24). It could be the possibility that for food retail organisations, due to the high storage requirements and short shelf life of their goods (2.24), they would be more interested in the functionality of smart warehouses. However, when we searched for food retail organisations and intelligent logistics, we found little relevant literature.

In the literature review authors did not find literature specifically on the timeliness of intelligent logistics. The benefits of intelligent logistics are more often focused on the convenience and reduced labour costs that smart robots bring (Anica-Popa et al., 2021, Karabegovic et al., 2015), and the benefits of timeliness are scattered among these ideas. However, R5 focused on the issue of timeliness and made the example of evaluating that an improvement in the timeliness of a single shipment can bring hundreds of billions of dollars to the total physical system as a whole (5.48). It would be of great help for these retail organisations if more literature focus on the timeliness gains through intelligent logistics technologies.

5.4.2 Challenges

There is a lot of overlap between the content of the interviews and the findings in the literature review, the first thing that was mentioned was the significant investment costs associated with intelligent logistics (1.50). With the exception of R2, who had built an intelligent logistics system right from the beginning, the rest of the respondents had made the transition from traditional logistics to intelligent logistics. They have all invested more or less in transformation costs or R&D costs (1.50,2.43,3.34,4.16,5.50,6.72). Interestingly, however, different retail organisations have different perceptions of upfront investment. For the relatively small organization of respondent R3 and R4, they perceive the building of an intelligent logistics system to be very expensive (3.32,3.34, 4.38). However, for large e-tailing organisations, respondents R1, R5 and R6 are very willing to invest heavily in intelligent logistics systems, even to the extent of developing their own robots or acquiring related technology companies (1.50,5.50, 6.72). While all of the six respondents agreed that intelligent logistics technology offers significant long-term benefits, large scale retail organisations are more willing to develop intelligent logistics technology in-house and as part of their investment rather than just as a cost saving (1.50, 5.50, 6.72). Even R5 and R6 indicated that they would continue to research new technologies, for example, R5 would research more into green logistics (5.54) and R6 would research driverless technology (6.74) The comparison between the different respondents gives us a new insight into the cost of intelligent logistics, not just in terms of short-term investment versus long-term return on investment, but also in terms of the retail organisation's It is also important to look at the size and purpose of the retail organisation. Different sizes of retail organisations have different needs for intelligent logistics and different concerns about investment costs. Another point of interest is the view of R2, who has used intelligent logistics technology from the outset and therefore showed a very positive attitude when asked about their views on the cost of Intelligent logistics (2.42). Although R2 is smaller than R3 and R4, it shows a more relaxed attitude towards logistics costs.

Therefore, for retail organisations that want to develop Intelligent logistics in the future, we suggest that firstly, depending on the size of the organisation, it is reasonable to decide whether to buy existing Intelligent logistics technology or to develop and invest in Intelligent

logistics technology in-house. Secondly, in the case of start-ups, we recommend adopting intelligent logistics technology from the outset, which can save a lot of money on retrofitting logistics technology and reduce costs better.

Government policies and strategies were mentioned in the literature review, and respondents also mentioned in the interviews that they would like more information support (3.48,5.56). R3 mentioned the desire for a unified intelligent logistics system that would allow different companies to share logistics information in real time (3.48). The importance of the role of government in the development of new strategies and policies was mentioned in the literature review (Dinu, 2021). This view was more strongly supported by our respondents.

The issue of human resources was an issue highlighted by both the literature review and the respondents. Intelligent logistics is replacing traditional human labour and putting a squeeze on the work of traditional logistics workers (Henderson & Pearson, 2011). Authors did identify the existence of these problems during the interviews. R1, R3 and R4 all mentioned the replacement of logistics workers' jobs and positions (1.58, 3.28, 4.54), but they had different strategies for dealing with them. Rather than expressing concern about the loss of jobs for logistics workers, R4's strategy is interesting in that they have actively trained and upgraded the skills of traditional logistics workers (4.36). Interestingly enough such training has brought benefits to both logistics workers and companies. In addition to helping traditional logistics workers to transition, R4 said that training the skills of their former employees has also saved the company the cost of recruiting and training new people (4.36). This shows that the training of former traditional logistics workers is a win-win strategy. But the literature review also mentions that the issue of logistics talent increases the burden on employers, one of which is the need to train a new pool of logistics workers with specialist skills (Scheiber, 2018). Here again, we suggest that a special training institution could be considered to be responsible for the technical training of logistics workers in individual retail organisations, after which the company would then provide specific training in line with its own specific situation. This could partially reduce the pressure on employers.

Although the literature talked about the customer privacy and security issues, however, during the interviews, none of the respondents mentioned the challenges of the customer privacy. This was due to our time constraints and the fact that we did not conduct a study on the privacy and security concerns related to intelligent logistics. This is where this thesis is limited.

6 Conclusions

This last chapter of our research concludes the findings of this research by providing the answer to our research questions through some of our key findings. The chapter also includes the future directions for the researchers who are interested to explore this topic of research further.

6.1 Research question and key findings

The aim to undertake this research was to investigate the outcomes of intelligent logistics in retail organizations and to provide answer to our research question:

- What is the outcome of intelligent logistics in retail organizations?

To get an answer for this question, we explored the different technologies being used in intelligent logistics, how these technologies are benefiting the retail sectors as well as what are the associated challenges with intelligent logistics, especially in context with the retail organizations. This was carefully done with the help of reviewing existing literature and developing a derived theoretical framework. Also, semi-structured qualitative interviews were performed with some of the large scale- retail organizations.

The findings of this research concluded that all the large-scale global retailers have already been shifted to intelligent logistics a long time ago to handle their huge logistic volume efficiently which was not possible through traditional logistics methods that heavily relied on manual handling. They made this shift by analysing the customer demands, changing business landscape and due to other environmental factors associated and sometimes to manage their internal performance and business tasks efficiently. The retail organisation also mentioned the impact of the logistics module on their costs and customer satisfaction, which directly or indirectly affects their organisation's revenue. It was found that the improved timeliness and rational distribution of goods due to intelligent logistics increases the customer loyalty of retail organisations.

Almost every organization showed great willingness to adopt new technologies that are most appropriate for their business nature. Although the adopted technologies are already providing benefits, there is still a lot to be done. Out of those many things, having a unified logistic information platform is one the main requirement to access all the suppliers and retailer information over one platform. These organizations also showed an increasing interest to incorporate the element of sustainability in their organization to become more environmentally friendly.

The findings also suggest that intelligent logistics helps retail organisations to improve logistics timeliness, improve logistics delivery quality and reduce logistics costs. This makes intelligent logistics an inevitable direction for the future development of logistics in retail organisations. Artificial intelligence and automated robots enable organisations to better respond to the challenges of unexpected situations. In the concrete implementation phase, the organisations interviewed encountered different challenges. The investment cost of intelligent logistics

is an issue that cannot be ignored. Almost all respondents mentioned the increased costs associated with adapting intelligent logistics technologies. Also, this is currently a research gap in literature, and there could be room for more research in the future. The transition of traditional logistics workers and the demand for highly skilled talent also adds to the operational costs for organisations. Respondents also gave suggestions to train workers to prepare them for the inevitable future transition.

6.2 Future directions & limitations

As the aim of this research was also to provide insight to the researchers who are interested to explore this field further, the future direction for this topic is diverse being the fact that the topic is still emerging academically. There has very little already been done in literature and a lot can be achieved in future. When it comes to the intelligent logistic technologies, most of the literature talks about IoT, cloud computing and big data and AI while lacks research in unmanned logistic warehouses, robotics, AGV, stacker cranes and drones, which was found to be most commonly used in retail industry along with deep learning AI algorithms, IoT, big data and cloud computing, through the interviewed retail organizations. While most of the literature talks about the strategic benefits of logistics in retail organizations, there is a need to search more about the technological benefits of intelligent logistics in retail organization. The future researchers can also focus on the significance of making the logistics activities more sustainable and environmentally friendly by using the concept of intelligent logistics.

When we conducted literature research on the drawbacks of Intelligent logistics, we found discussions about customer privacy and security issues. However, due to the limited scope of this thesis we were not able to touch this topic in our findings and neither did any respondent mention the security concern explicitly. Yet extreme cases of intelligent robots causing injury or even death to logistics workers were mentioned in the literature review. We also did not touch upon the topics of organization culture and its influence in embracing the intelligent technologies: therefore, further research can be conducted in these areas. This is where the thesis is limited

Appendix 1 -Transcription of interview 1

Interviewer 1: Yujie Li (YL)

Respondent R1 (R1)

Company: Jindong

Type of company: E-commerce retail organization

Role: Head of our Smart Warehouse in East China at Jingdong Logistics

Date: May 8th 2021

Interview Length: 1 hour and 15 minutes

Language: Chinese

Number of words: 6968

Row	Person	Transcription(Original Chinese)	Transcription(English Translation)	Code
1.1	YL	我们现在就开始吧。	Let's get started now.	
1.2	R1	好的。你们是否在录制并公开这次采访？我不公开姓名了吧。	OK. Are you recording and making this interview public? I'm not going to disclose the name, I guess.	
1.3	YL	好的没问题。你能不能先简单介绍一下你的工作职位和职责	Okay no problem. Can you start by giving a brief description of your job title and responsibilities	
1.4	R1	让我简单介绍一下我的职位。我是我们京东物流华东地区智能仓的负责人。我主要负责华东地区智能仓的转型和发展。	Let me briefly introduce my position. I am the head of our Smart Warehouse in East China at Jingdong Logistics. I am mainly responsible for the transformation and development of the Smart Warehouse in East China.	

1.5	YL	好的，那是否可以简单介绍一下京东的主要业务？	Okay, so can you give a brief introduction to the main business of Jingdong?	
1.6	R1	我想大家对京东集团都很熟悉，尤其是在中国。	I think we are all familiar with the Jingdong Group, especially in China.	
1.7	YL	是的，作为一个中国人，特别是我也非常喜欢网上购物，我对京东非常熟悉。我们以前对京东的了解主要是作为一个电子设备的在线销售平台。在过去的几年里，你们的业务有变化吗？	Yes, as a Chinese person, especially as I am also very fond of online shopping, I am very familiar with Jingdong. What we used to know about Jingdong was mainly as an online sales platform for electronic equipment. Has your business changed in the last few years?	
1.8	R1	京东作为电子设备的销售平台已经有很长一段时间了。大概是在2010年之前，我们主要关注的是电子设备的销售。我们的口号是，京东从来不卖假货。但在2010年之后，我们逐渐扩大业务范围，包括销售日用品、食品、服装等。我们还接受了许多第三方平台零售商，在我们的平台上销售他们自己的产品。	Jingdong has been a sales platform for electronic equipment for a long time. It was probably before 2010 that we focused mainly on the sale of electronic equipment. Our slogan was that Jingdong never sells fake products. However, after 2010, we gradually expanded our business to include the sale of daily necessities, food, clothing and so on. We have also accepted many third party platform retailers to sell their own products on our platform.	
1.9	YL	谢谢你，我们理解了。京东不仅要销售自己的商品，同时也有第三方平台的商品。那么，京东的日常主流物流业务是那个多一些呢？	Thank you, we understand. Jingdong not only sells its own goods, but also goods from third-party platforms. So, is that more of Jingdong's day-to-day mainstream logistics business?	
1.10	YL	主要还是配送我们自己的商品。由于我们的商	It's still mainly delivering our own merchandise. Since our goods are in our Smart	SW

		品都是在我们的智能仓库中，所以配送一体化服务更好。当然也有很多第三方平台会想将商品存放在我们的仓库中。	Warehouses, the delivery integration service is better. Of course there are also many third party platforms that would like to store their goods in our warehouses.	
1.11	R1	那一般你们日常的物流业务量是多少呢？	And what is the general volume of your daily logistics business?	
1.12	YL	因为我是负责华东地区的，我可以告诉你华东地区的物流业务量。如果遇到 11.11、618 等大的促销活动，一天 1000 万的物流业务量和订单是正常的。如果你计算一下京东在整个中国和海外市场的物流业务量，可能是一年几十亿件包裹。	As I am responsible for the East China region, I can tell you the logistics business volume in East China. If you encounter big promotions such as 11.11 and 618, 10 million logistics business and orders a day is normal. If you calculate the logistics business volume of Jingdong in the entire Chinese and overseas markets, it could be billions of parcels a year.	LV
1.13	R1	这个物流量真的很惊人。2018 年，京东创始人刘强东先生提到，要大力发展京东物流。京东物流目前在 1.京东企业中扮演什么角色？	This volume of goods is really amazing.In 2018, Mr. Liu Qiangdong, the founder of Jingdong, mentioned that he wanted to develop Jingdong Logistics vigorously. What role does Jingdong Logistics currently play in the Jingdong enterprise?	
1.14	YL	京东物流是我们的招牌之一。使用过京东的消费者都知道，由于京东物流的存在，消费者可以在当天下单，并在当天到达。许多消费者选择我们是因为他们相信我们的产品是真实的，我们的价格是好的。另一个重要原因是京东物流的高时效性。京东在	Jingdong Logistics is one of our signatures. Consumers who have used Jingdong know that thanks to Jingdong Logistics, consumers can place their orders and have them arrive on the same day. Many consumers choose us because they believe our products are genuine and our prices are good. Another important reason is the high	LR

		2008 年决定建立自己的物流，所有的包装、仓储和运输都由自己完成。2010 年，我们还建立了门到门的取货服务。我们是第一波提供物流追访服务的零售商之一。它允许消费者通过移动应用程序和网络端实时跟踪和检查实时物流。智能仓库的使用有效结合了地理优势，促进了更有效的交货时间。	timeliness of Jingdong's logistics. Jingdong decided to set up its own logistics in 2008, doing all the packing, warehousing and shipping ourselves. in 2010, we also set up a door-to-door pick-up service. We were one of the first wave of retailers to offer a logistics catch-up service. It allows consumers to track and check real-time logistics in real time via a mobile app and webside. The use of Smart Warehouses effectively combines geographical advantages and facilitates more efficient delivery times.	
1.15	R1	那这几年物流业务量有什么变化吗？	And has the volume of logistics business changed over the years?	
1.16	YL	物流量每年都在涨。尤其是疫情期间，我们的订单量又上涨了 10%，相应的物流业务量也上涨了 12%。	The volume of goods has gone up every year. During the epidemic in particular, our order intake went up by another 10 per cent, with a corresponding rise in logistics business of 12 per cent.	LV
1.17	R1	那物流的增长速度很惊人啊。尤其是在这么大的基数下。那这样的增加幅度下，你们的物流效率和质量有什么变化吗？	That's an impressive growth rate for logistics. Especially with such a large base. So with such an increase, has there been any change in the efficiency and quality of your logistics?	
1.18	YL	这值得称赞一下。虽然物流业务量每年都在上涨，但是我们的物流配送效率和质量也是每年都在进步。你是不是在在京东购物过呀？你自己有什么感觉呢？	That deserves some praise. Although the volume of logistics business has been rising every year, the efficiency and quality of our logistics delivery has also been improving every year. Have	

			you ever shopped at Jingdong? How do you feel about it yourself?	
1.19	YL	的确，我作为京东的消费者之一，也特别喜欢京东物流。它的及时性确实让我吃惊！那么，面对每天数以百万计的货物，公司是如何做到高效处理的呢？	Indeed, as one of Jingdong's consumers, I also particularly like Jingdong logistics. I am amazed by its promptness! So, how does the company manage to handle millions of shipments every day in an efficient manner?	
1.20	R1	每天有这么多的流量，当然不可能只靠人去处理。当然，我们会使用现在非常先进的智能物流技术。2014 年我在京东工作的时候，我们已经开始建设 "亚洲第一 "的智能仓库，2017 年，我们成立了京东物流集团，专注于智能物流，这可以大大提高我们物流配送的效率。	With so much traffic every day, it is of course impossible to rely solely on people to handle it. Of course, we will use the very advanced intelligent logistics technology now. when I worked at Jingdong in 2014, we had already started to build the "No.1" Smart Warehouse in Asia, and in 2017, we set up Jingdong Logistics Group to focus on intelligent logistics, which can greatly improve the efficiency of our logistics delivery.	SW
1.21	YL	谢谢你的分享，京东集团在智能物流技术方面已经尝试了很长时间。您能和我们分享一两个公司成功使用智能物流的案例吗？	Thank you for sharing that Jingdong Group has been experimenting with intelligent logistics technology for a long time. Can you share with us one or two examples of companies that have successfully used intelligent logistics?	
1.22	R1	这方面的例子有很多。虽然我们京东物流集团成立的时间不长，但技术还是很先进的。每年我们都会投入大量的资金进行研究，使智能物流更快、更准确。对于零售商而已，只有物流	There are many examples of this. Although our Jingdong Logistics Group has not been established for a long time, the technology is still very advanced. Every year we invest a lot of money in research to make intelligent lo-	SL

		有了保障，才能更好地抓住消费者，拓宽市场。	gistics faster and more accurate. For retailers only, only when logistics is guaranteed can we better capture consumers and broaden the market.	
1.23	YL	我知道京东商店是有中国境内的国内版本，和海外版两种。那是在哪个市场的技术投入更大呢？	I know the Jingdong Store is available in both a domestic version within China, and an overseas version. So which market is the bigger technology investment in?	
1.24	R1	事实上，京东的智能物流在中国市场的投入更大。中国市场是京东集团的主要收入来源，而中国的物流成本与欧美国家相比更高。因此，建立自己的智能物流系统可以有效降低物流成本，有利于京东的市场竞争。	In fact, Jingdong's intelligent logistics is more invested in the Chinese market. The Chinese market is the main source of revenue for the Jingdong Group, and logistics costs in China are higher compared to those in Europe and the US. Therefore, building its own intelligent logistics system can effectively reduce logistics costs and help Jingdong compete in the market.	CR
1.25	YL	我有点好奇，因为中国的劳动力成本与欧洲和美国相比实际上要低得多。为什么中国的物流成本会比欧洲和美国市场的物流成本高呢？	I'm a bit curious because labour costs in China are actually much lower compared to Europe and the US. Why are logistics costs in China higher than in the European and US markets?	
1.26	R1	因为物流成本不仅受到劳动力成本的影响，还受到货物数量、配送方式、物品分类的时间成本等的影响。虽然中国的劳动力成本很低，但中国是一个大的地区。而且绝大部分商品都是送到消费者手中，而不是放在取货点，这些都	Because logistics costs are affected not only by labour costs, but also by the quantity of goods, the method of distribution, the time cost of sorting items, etc. Although labour costs in China are low, China is a large region. And the vast majority of goods are delivered to consumers rather than left at pick-up points, all of which	LR,LC

		需要更多的人力来运送。而且中国有很多城市地区，有很多订单，这也为分拣工作创造了很多成本。这就是我们开始思考智能物流的原因。	require more manpower to deliver. And China has a lot of urban areas with a lot of orders, which also creates a lot of costs for picking work. That's why we started thinking about intelligent logistics.	
1.27	YL	您提到了分拣工作。那京东是怎么提高分拣的效率呢？	You mentioned picking work. And how does Jingdong improve the efficiency of picking?	
1.28	R1	最早的时候是人工分拣，一个仓库一天最多只能分拣 20-30,000 件。那是目前数量的 5%。后来，越来越多的人在网上购物，订单量增加。如果仅仅依靠人工分拣，肯定是不可能的。我们就开始使用机器人分拣，这样我们就可以一天 24 小时分拣。而随着这次 Covid-19 疫情的爆发，很多依靠人工分拣的物流行业都暂停了运营。京东物流的无人智能仓库就能很好体现其优势。	In the early days it was manual picking and a warehouse could only pick up to 20-30,000 pieces a day. That's 5% of the current volume. Later on, more and more people were shopping online and the volume of orders increased. It would certainly not have been possible to rely on manual picking alone. We then started using robots for sorting so that we could sort 24 hours a day. And with this Covid-19 outbreak, many logistics industries that rely on manual picking have suspended their operations. JD Logistics' unmanned Smart Warehouses are a good example of its advantages.	RO,EF
1.29	YL	你能告诉我们更多关于你刚才提到的智能仓库和机器人分拣的情况吗？	Can you tell us more about the Smart Warehouses and robotic picking you mentioned earlier?	
1.30	R1	智能仓库的区别于传统的存储仓库。里面分拣货物的不再是以往的物流工人，而是我们的机器人。	Smart Warehouses are different from traditional storage warehouses. It's no longer the logistics workers of old who sort the goods inside, but our robots.	SW,RO

1.31	YL	我知道这项技术！很多零售商都有运用这项智能物流技术。就像阿里巴巴和亚马逊一样。	I know about this technology! Many retailers are using this intelligent logistics technology. Just like Alibaba and Amazon.	
1.32	R1	是的，最早也是亚马逊首先使用智能机器人技术的。我们也是想它们学习的。	Yes, it was also Amazon that first used intelligent robotics in the first place. We want to learn from them too.	
1.33	YL	那目前京东机器人技术运用的怎么样呢？	And how is the use of robotics in Jingdong so far?	
1.34	R1	效果很好。我们很少收到客户关于丢失物品或发错物品的投诉。我也在淘宝上购物，偶尔会遇到一些商家给我发错物品的情况。但在京东物流，我敢打赌，我不会遇到这种情况。我们的每件产品都有相应的标签来识别。货物被贴上条形码，条形码被输入系统，这样货物就可以被准确地识别和分类。而且我们平均每小时可以拣选 12,000 件商品，效率大大提高，降低了劳动成本。	It's working very well. We rarely receive complaints from customers about lost items or wrong items being sent. I also shop on Taobao and occasionally I encounter some merchants who send me the wrong items. But with Jingdong Logistics, I bet I won't encounter this. Each of our products is identified by a corresponding label. The goods are barcoded and the barcodes are entered into the system so that the goods can be accurately identified and sorted. And we can pick an average of 12,000 items per hour, which is much more efficient and reduces labour costs.	EF,CR
1.35	YL	而在使用智能物流技术后，物流效率有什么变化？	And how has logistics efficiency changed with the use of intelligent logistics technology?	
1.36	R1	最明显的就是正确率和效率的改进了。以我们的无人仓库为例，它有一个自动分拣系统，可以达到 99%的正确率。	The most obvious is the improvement in correctness and efficiency. Our unmanned warehouse, for example, has an automated picking system	EF

		这比人工分拣要好得多。	that can achieve a 99% correct rate. This is much better than manual picking.	
1.37	YL	确实是的，那京东还有运用什么智能物流技术吗？	Yes indeed, so what other intelligent logistics technologies does Jingdong use?	
1.38	R1	智能仓库里的技术还没说完呢。我们的智能仓库是京东智能物流的一个重要组成部分，目前主要由这三部分组成。第一，自动化技术，这个主要是负责商品的入库和出库。系统会自动将商品放在收货平台上。接收平台有几个端口，分别用于接收和运输。系统自动将商品运送到货架上，有效减少了人工操作，提高了备货的效率和准确性。工作人员可以不费吹灰之力拿起货盘。我们的托盘侧面有一个吸力装置，地面上有一块磁铁将托盘固定住，这样工作人员就可以不费吹灰之力将其拉走。不仅如此，他们还可以迅速将托盘运到需要的地方，节省了精力和时间。	The technology in the Smart Warehouse isn't finished yet. Our Smart Warehouse is an important part of Jingdong's intelligent logistics, which currently consists of these three main components. Firstly, the automation technology, this is mainly responsible for the inbound and outbound storage of goods. The system will automatically place the goods on the receiving platform. The receiving platform has several ports for receiving and transport. The system automatically transports the merchandise to the shelves, effectively reducing manual operations and improving the efficiency and accuracy of stock preparation. Staff can pick up the pallets with little effort. Our pallets have a suction device on the side and a magnet on the floor to hold the pallet in place so that staff can pull it away with little effort. Not only that, but they can quickly transport the pallet to where it needs to be, saving effort and time.	SW
1.39	YL	这个技术很棒，把每位物流工人都变成大力士了。	This technology is great and turns every logistics worker into a Hercules.	

1.40	R1	哈哈哈是的。第二项技术就是堆垛机和我们的分拣系统。我们可以告诉你我们的 "亚洲一号 "仓库项目。"亚洲一号 "使用的是过道式堆垛机，它可以在高层货架之间灵活地运行。你见过堆垛机吗？	Yes. The second technology is the stacker cranes and our sorting system. We can tell you about our "Asina No.1" warehouse project." Asina No.1 uses aisle stacker cranes which are flexible between high level shelves. Have you ever seen a stacker crane?	
1.41	YL	并没有见过。	It has not been seen before.	
1.42	R1	堆垛机是可以通过提升和伸缩货叉在货架上水平或垂直地移动货物，这使得它可以在狭窄的过道中自由移动并拾取货物。这使我能够更紧凑地放置货架，增加我们仓库的容量。而且，堆垛机的高起重能力使它很容易提升重物，可以在任何时间内进入仓库。而且在我们的亚洲第一仓库中，堆垛机在运行过程中无需人工控制，可以实现自动化，大大提高了物流作业的效率。	The stacker crane is able to move goods horizontally or vertically on the shelves by lifting and telescoping the forks, which makes it possible to move freely and pick up goods in narrow aisles. This allows me to place the racks more compactly and increase the capacity of our warehouse. Furthermore, the high lifting capacity of the stacker crane makes it easy to lift heavy loads that can be in the warehouse in no time at all. And in our No. 1 warehouse in Asia, the stacker crane can be automated without manual control during operation, greatly increasing the efficiency of logistics operations.	RO,OT,AGV
1.43	YL	原来如此。那第三项技术是什么呢？	So that's it. And what is the third technology?	
1.44	R1	第三就是我们之前他到的的智能机器人，也叫机器人分拣。2018 年，我们的京东搬运机器人 "土狼 "开始投入使用。当时最重要的考虑是搬运机器人所能处理的货物重量。这个机	The third is the intelligent robot we arrived at before he, also called robot sorting. 2018 saw the start of our Jingdong handling robot "Coyote". The most important consideration at the time was the weight of the goods that the handling robot	RO,OT,AGV

		器人是由京东开发的，可以承载 300 公斤的重量，这使得它可以快速移动商品，使工作人员更容易找到商品。 另外，在操作过程中，智能机器人不会发生碰撞或撞到障碍物，因为系统设置了规划路线。即使有多个机器人一起工作，它们也会严格按照既定路线运送货物，不会发生混乱。	could handle. This robot was developed by Jingdong and can carry up to 300 kg, which allows it to move goods quickly and makes it easier for staff to find them. In addition, during operation, the intelligent robot does not collide or hit obstacles, as the system is set up to plan routes. Even if there are multiple robots working together, they will deliver the goods in strict accordance with the set routes without confusion.	
1.45	YL	原来如此。那目前你们有投入多少个机器人呢？	So that's it. How many robots have you put in place so far?	
1.46	R1	以我们”亚洲一号”仓库为例。我们投入了有 500 个机器人。	Take our "Asina No.1" warehouse for example. We have 500 robots in place.	RO
1.47	YL	这么多！那么，随着这些智能物流技术的使用，你的物流成本有什么变化？	So much! So how have your logistics costs changed with the use of these intelligent logistics technologies?	
1.48	R1	从长远来看，物流成本肯定下降了。毕竟，我们现在的分拣效率更高、更正确。而且现在仓库可以 24 小时运行，这就保证了我们每年的货物量在增加的同时，及时性也在增加。而且我们很少有丢失或漏送的物品，这就减少了很多额外的索赔、换货等费用。	In the long run, logistics costs have definitely gone down. After all, we are now picking more efficiently and correctly. And the warehouse can now run 24 hours a day, which ensures that the volume of goods we deliver each year is increasing along with timeliness. And we rarely have any lost or missed deliveries, which reduces the cost of many additional claims, exchanges, etc.	CS,CRC,CR
1.49	YL	那就目前近几年的物流成本而言，这些系统构	So what about the current logistics costs in recent years, what about these system	

		建和机器人研发生产，这些物流成本怎么办呢？	builds and robot development and production?	
1.50	R1	近几年来是投入了大量的科研成本和仓库改造的成本。这是远远超过效益。但作为一个大型企业，我们必须有长远的考虑。虽然在改造阶段成本大于效益，但几年之后，我们可以肯定，效益是大于成本的。而这也是这个物流的发展趋势，每个企业肯定都在努力跟随最新的技术。谁都不想被时代淘汰，不是吗？	In recent years is invested in a lot of research costs and the cost of warehouse renovation. This is far more than the benefits. But as a large company, we have to think long-term. Although in the renovation phase the costs outweigh the benefits, after a few years we can be sure that the benefits outweigh the costs. And this is the trend in this logistics, and every company is certainly trying to follow the latest technology. No one wants to be out of date, do they?	
1.51	YL	那么客户是怎么评价京东的智能物流呢？	So what do customers say about Jingdong's intelligent logistics?	
1.52	R1	客户其实很少关系我们到底使用哪种办法配送商品的。不管是智能物流也好，还是传统的人工分拣。客户更加关系的是什么时候包裹能送到。送到的时候包装好不好。	Customers rarely actually care which method we use to deliver goods. It doesn't matter whether it's intelligent logistics or traditional manual sorting. What customers are more concerned about is when the package will be delivered. Whether the package arrives in good condition or not.	CS
1.53	YL	那客户是怎么评价物流时效性的呢？	And what do customers say about the timeliness of logistics?	
1.54	R1	京东物流在这方面我可以说是业界数一数二的了。我们做过用户调研，我们物流配送是客户首先在京东购买商品的三大原因之一。可见	I would say that Jingdong Logistics is one of the best in the industry in this respect. We have done user research and our logistics is one of the top three reasons why customers buy from Jingdong in	CS,EF

		我们改进后的物流技术是广受客户好评的。	the first place. This shows that our improved logistics technology is well received by our customers.	
1.55	YL	以前的京东物流评价也是很好的。	The previous Jingdong logistics reviews were also very good.	
1.56	R1	哈哈是的，但是以前的物流成本高啊。不只是人工成本，时间成本也很高啊。现在有了智能物流之后，节约了不少呢！	Haha yes, but the logistics cost was high in the past. Not only the labour cost, but also the time cost is high. Now with intelligent logistics, it's saving a lot!	LC,CR
1.57	YL	那是的！么你的智能物流使用了大量的自动化，基于机器的操作，这对物流工人是否有影响？他们如何看待智能物流？	That's right! Does your intelligent logistics use a lot of automation, machine based operations, does this have an impact on logistics workers? How do they view intelligent logistics?	
1.58	R1	智能物流无疑对物流工人产生了影响。目前我国仓库的员工数量已经下降了六分之一。随着智能仓库在更多城市的推广，拣货、进货、出货等这些岗位肯定会被机器取代。这也是一个不可避免的趋势。但大量的裁员不会在短时间内发生。我国智能仓库的发展还需要一定的时间，但人才类型的变化是必然的。	Intelligent logistics has undoubtedly had an impact on logistics workers. The number of employees in our warehouses has now fallen by a sixth. As Smart Warehouses are rolled out in more cities, picking, incoming and outgoing goods and other such positions will definitely be replaced by machines. This is also an inevitable trend. But a large number of layoffs will not happen anytime soon. The development of Smart Warehouses in China will take some time, but the change in the type of talent is inevitable.	EAL
1.59	YL	既然您提到了人才类型的转变，能否请您分享一下在智能物流方面，	Since you mentioned the change in the type of talent, can you please share what you expect or improve on	

		您对这项技术有什么期望或改进？	this technology in terms of intelligent logistics?	
1.60	R1	我认为有两点。第一是对人才的需求。实际上，与一些欧美同行相比，我们在智能物流方面起步比较晚。我们现在急需培养高端人才。随着我们未来智能物流的不断发展，传统的分拣人才已经不能满足智能仓储人才的需求。最基本的是要能熟练使用计算机系统。所以我们需要大量的高素质人才。第二是信息的共享。京东没有一个专业的智能物流信息平台。它还不能准确解决消费者在快递终端取货的问题，因为快递终端距离太远，时间上不方便。这不利于俘获潜在的消费者。与我们的竞争对手相比，阿里巴巴有自己的物流信息平台。这是我们必须要解决的问题。	I think there are two things. The first is the demand for talent. In fact, compared to some of our European and American counterparts, we started relatively late in intelligent logistics. We now urgently need to train high-end talents. As our future intelligent logistics continues to develop, traditional sorting talent can no longer meet the demand for intelligent warehousing talent. The most basic thing is to be able to use computer systems proficiently. So we need a lot of high quality talent. The second is the sharing of information. Jingdong does not have a professional intelligent logistics information platform. It cannot yet accurately solve the problem of consumers picking up goods at courier terminals, which are too far away and inconvenient in terms of time. This is not conducive to capturing potential consumers. Compared to our competitors, Alibaba has its own logistics information platform. This is something we have to address.	FP,EAL
1.61	YL	谢谢你！。在结束之前，您是否希望再补充一些东西？	Thank you!. Do you wish to add something more before closing?	
1.62	R1	不，也谢谢你。	No, thank you too.	

1.63	YL	如果有任何其他问题，我们可以再次联系您吗？	Can we contact you again in case of any additional questions	
1.64	R1	当然可以。任何时候只要提前给我发短信就可以了。	Yes of course. Any time just text me in advance.	
1.65	YL	非常感谢你接受采访并帮助我们进行研究。祝您有一个愉快的一天!	Thank you very much for the interview and for helping us with our research. Have a nice day!	

Appendix 2 -Transcription of interview 2

Interviewer 2: Yujie Li (YL), Hira Khalid (HK)

Respondent (R2): Sherry Gumei

Company: C2

Type of company: A food retail company

Role: Logistics Management Manager of intelligent logistics system.

Date: May 8th 2021

Interview Length: 55 minutes

Language: English

Number of words: 2312

Row	Per-son	Transcription	Code
2.1	YL	Hello, can we start now?	
2.2	Sherry	Ok	
2.3	YL	Ok, could you please give us a brief description of your job title and responsibilities?	
2.4	Sherry	I am the Logistics Management Manager for our corporate intelligent logistics system. My main responsibilities are to manage our intelligent logistics system and to regularly visit our offline shops to check the logistics of our warehouses.	
2.5	HK	Thank you. And what are your company main business activities?	
2.6	Sherry	Our company is a new retail food business that combines online and offline. Our product categories include not only meat, fish, fruit and vegetables, rice, flour and oil, which need to be processed, but also dried fruits, baked goods, cooked goods and other products.	
2.7	HK	We also offer ready-to-eat items such as dried fruit, baked goods, cooked food and Japanese cuisine. We also sell local specialities depending on the city where our offline shops are located. We will also recommend different local	

		specialities based on the city where the user is positioned on our app.	
2.8	Sherry	So that's it. So what is the number of shops in your company?	
2.9	YL	Our shops are mainly located in 12 cities, and we currently have 154 shops.	
2.10	Sherry	The exact volume of our logistics business is a trade secret and I can't talk about it. But I can tell you that we have an average of 3,000-5,000 different types of fresh fruit, vegetables and cooked food in just one shop. And as a food retailer, we have even more stringent requirements for logistics, timeliness and safety. Our company also has an online supermarket, which allows consumers to shop online. For online orders, we have the option to deliver within 30 minutes. So we have a large logistics business.	LV,SL
2.11	YL	Thank you for sharing your experience. From your description, I feel that logistics is a very important part of your business. Has there been any change in the company's logistics business volume in recent years?	
2.12	Sherry	At the moment we are still in the segment of shop and business scale expansion. So the volume of our logistics business is definitely on the rise. I can't tell you the exact figures, but we've always had a leading edge compared to our competitors.	LV,CRC
2.13	HK	Thank you. Earlier you mentioned that customers can choose a 30-minute home delivery service. How do customers rate the company's logistics service?	
2.14	Sherry	Our logistics is still highly rated by our customers. Many customers choose to buy our products because of our efficient and high quality delivery service. In particular, our 30-minute home delivery service is very popular.	CS
2.15	HK	Thank you. As the logistics manager of your company's intelligent logistics system, can you share with us what intelligent logistics technology your company uses? Or share one or two success stories?	
2.16	Sherry	We use a lot of technology, so it's not just one or two examples.	
2.17	HK	We would definitely like to know all the technologies, if you are willing to do so.	

2.18	Sherry	First of all our intelligent logistics technology is related to our business model. By defining our shops as offline experience shops, consumers can browse products on their mobile phones before going to the physical shop to experience them. Purchases at the physical shop will be guided by an attendant to download the APP, register as a member and eventually pay. Afterwards, consumers can choose to place orders directly on the APP and have them delivered by a delivery person or go to the shop to experience consumption and enjoy after-sales services such as no-reason returns. We will use the big data management centre to build up a membership profile, thus getting a better grasp of the individual user's purchase intentions.	
2.19	HK	Is your main business online or offline?	
2.20	Sherry	At the moment our online and offline turnover is about the same. But our main business is through our offline shops.	
2.21	YL	Why do you say through the shops?	
2.22	Sherry	Because in addition to being a retail terminal, our shops are also our intelligent logistics warehouse. If a user places an order on the app, we will automatically match them to the nearest shop and deliver the goods. This requires our intelligent logistics system to do the analytical work behind the scenes. Whether the purchase is made in the shop or the order is placed on the online APP, we will guide or help the customer to register as a member, and will collect and analyse the user consumption data. We can then analyse the consumption preferences of users in this area. And according to the preferences of the corresponding goods to change the stock, which can help us rational allocation of goods.	
2.23	YL	So that's it. As a retailer in the food industry, is your logistics model different from that of other retailers?	
2.24	Sherry	Of course there are many differences. We have much higher requirements for timeliness and stock levels than other retailers. As most of our fresh food products have a short shelf life, we are keen to achieve 'zero inventory' through the use of artificial intelligence and big data. We are able to control our operating costs effectively and keep our inventory under control. In addition, through the analysis of user consumption data, backstage browsing records and transaction records, we can generally grasp the needs and preferences of consumers when shopping, so that we can make personalised recommendations	SL,AI,BD

		through APP or SMS to achieve the goal of accurate marketing.	
2.25	YL	Thank you! You said that big data management helps companies to achieve intelligent inventory management in intelligent logistics. Apart from big data, what new technology does the company have in the actual logistics delivery?	
2.26	Sherry	Our retail logistics and distribution is still largely based on big data and cloud computing analysis. One of the other important ideas is decentralization. We adhere to a direct sourcing model, delivering directly from frontline suppliers to shops.	BC,BD,CC
2.27	HK	Can you tell us more about the design of decentralization?	
2.28	Sherry	Decentralization means removing the old practice of buying goods from suppliers, moving them to the warehouse and then dispatching them from the warehouse to the shops. retail shops to traditionally warehouse goods, which caused a lot of logistics costs. And goods are easily damaged as they are constantly being replaced on the way to the truck. Especially goods like cold chain food, flowers and fruits are extremely susceptible to damage. So we use big data algorithms to work out the most suitable routes for delivery vehicles. We aim to deliver all the goods required by all the shops in the city from one vehicle.	BC, LC
2.29	HK	Thank you! How do you solve the need for shops to deliver online orders from customers in such a large area?	
2.30	Sherry	That's where our other intelligent logistics technology comes in. We call it the intelligent Fulfilment Order Collection algorithm. This is based on our user delivery address database and allows our AI algorithm to calculate the most appropriate route, time sequence, temperature layer, etc. Previously, retailers in the food industry had a one-to-one service. That is, one delivery person would travel to deliver one order at a time. But we can now deliver 2-3 orders at a time with one delivery person based on big data algorithms. This saves us a lot of money in logistics costs and increases our timeliness.	ILC,AI,BD,OT
2.31	YL	It does add a lot of efficiency. This way the delivery person can deliver one or two times more orders than before! You've mentioned your Smart Warehouse before. Is there any new technology in your Smart Warehouse?	

2.32	Sherry	Our intelligent shop warehouse operation system. As I said earlier, our offline shops are more like a logistics centre. Traditional shops don't care about product stock levels, and inventory can't be monitored in real time. However, we have an intelligent enough shop warehouse operation system. This system not only knows where each item is located and how orders are dispatched, but can also move between different types of work.	IoT,SW
2.33	YL	I see, so how do you know where each item is located?	
2.34	Sherry	Each item has its own individual "QR code", which is scanned by the logistics worker when it is placed and the QR code on the corresponding shelf. The system will then correspond to the goods and the cargo space one by one.	
2.35	YL	So there's so much technology in a smart warehouse! So you said earlier that you wanted to achieve zero inventory. How did you achieve zero inventory through big data?	
2.36	Sherry	Haha, so before I do that, let me ask you a question. What would you say is the most expensive thing about a shop?	
2.37	HK	Is it the rent of the shop?	
2.38	Sherry	Not really. One is the manpower and the other is the space. If you lay out goods that shouldn't be laid out, it will be a huge waste, but if there are no goods, customers will be disappointed. Based on these two points, we have designed an intelligent system for ordering stock allocation. On the one hand, it is based on the historical sales of the shop; on the other hand, it relies on user browsing data. By relying on this system we can do forecasts for the allocation of goods to different regions. "How can we measure this? We can see how many user clicks there are in the area and what percentage of page jumps to deals. Then we do back-end data calculations, constant iterations, constant optimisations to reach intelligent stock allocation. Other retailers can learn from the comfort of the shop, but not everyone can do it with a good enough inventory.	LC,BD
2.39	HK	Thank you! How has the company's revenue changed since these technologies became practical?	
2.40	Sherry	These have significantly reduced our operating and logistics costs, which of course has increased our revenue.	ILC,LR,CRC

2.41	HK	But does the adoption of these technologies increase the costs of conversion and technology introduction?	
2.42	Sherry	Actually, the costs are not that significant. Because we are a relatively new company, we already knew about intelligent logistics systems at the beginning of our company. As a food retailer, the focus on logistics is very high. So we are generally aware of the latest logistics technology. So we are quickly aligned to make the corresponding and application. So from the very beginning we have been using intelligent logistics technology, and that was already in the initial costs of the company.	ILC
2.43	HK	Thank you. What do the logistics workers in the company think about intelligent logistics?	
2.44	Sherry	Our company has been operating intelligent logistics and big data management since its inception. So all our employees have been trained in this system. They are all very much in agreement with this system.	EAL
2.45	YL	Does that mean that our employees are highly competent people from the very beginning?	
2.46	Sherry	Yes. From the beginning of our recruitment process, except for the frontline delivery staff, all of our employees are required to have some computer skills.	
2.47	YL	Thank you! And what is the next step for you as a manager?	
2.48	Sherry	The next step is that we want to optimise our algorithms as much as possible. To gradually expand the current half-hour delivery circle from the current 3km radius outside the shop to 4km and 5km. At the same time, we are also working extremely hard to promote sustainable logistics methods.	FP
2.49	YL	Can you tell us more about your approach to sustainable logistics?	
2.50	Sherry	Firstly, we will enhance the use of IoT technology to provide quality in the transport of our goods and reduce unnecessary waste.	
2.51	HK	Can you tell us more about what IoT technology you want to develop?	
2.52	Sherry	The most important thing we want to improve is the cold chain truck technology. At the moment, fresh produce is	SS,IoT

		mainly transported by cold chain vehicles. We hope to be able to use IoT technology to monitor the temperature and humidity inside the vehicle in real time through temperature control devices installed inside the vehicle to ensure that the entire cold chain does not fall off the chain. We have been gradually renovating the existing cold chain vehicles.	
2.53	HK	Thank you! Do you still have any expectations or dissatisfaction with this technology for intelligent logistics?	
2.54	Sherry	At the moment, I feel that the information is not publicized enough. For example, when I want to get more detailed information about suppliers, some of them are not yet part of the Intelligent Logistics network. Then there is a gap in the whole supply chain and the efficiency is greatly reduced. The rest is not there.	
2.55	HK	Thank you. Is there anything else you would like to add?	
2.56	Sherry	No, that's all I have to say.	
2.57	HK	Can we contact you again in case of any additional questions	
2.58	Sherry	Sure.	
2.59	HK	So that's all we have for today. Thank you for sharing and have a nice day.	
2.60	Sherry	You too, bye!	

Appendix 3 -Transcription of interview 3

Interviewer 3: Hira Khalid (HK), Yujie Li (YL)

Respondent (R3): Bettye Gray

Company: C3

Type of company: A electrical appliance retail company

Role: Director of logistics department

Date: May 10th 2021

Interview Length: 1 hour and 5 minutes

Language: English

Number of words: 2405

Row	Person	Transcription	Code
3.1	YL	Hello, would you allow us to disclose your name and company name for this interview?	
3.2	Bettye	Yes, you can. But please don't make the company name public.	
3.3	YL	Okay, if you feel there is sensitive information during the interview, you can always let me know.	
3.4	Bettye	Yes, I will.	
3.5	YL	Thank you. May we start with your job title? Can you give us a brief description of your position and what you do?	
3.6	Bettye	Good. I am the director of our company's logistics department. My day-to-day job is to check that our logistics orders are running properly and that the supply chain logistics are in order, in addition to my main job at the moment is to recommend the transformation of the company's logistics system.	
3.7	HK	Thank you. And what is the main business of your company?	
3.8	Bettye	We are a company a retail chain of home appliances. Initially our company sold small home appliances such as radios, fans and televisions. Later we slowly developed our import business, importing	

		appliances from Japan, Korea, the United States and many other countries. We have now become one of the largest home appliance retailers in China.	
3.9	HK	Thank you. You mentioned that your company is a chain, how many shops does it have in total?	
3.10	Bet-tye	At present, we have more than 1,700 shops in over 400 different cities.	
3.11	HK	That's a pretty impressive amount. No wonder it's one of the biggest appliance retailers. So may I ask what is the majority of the company's daily logistics volume?	
3.12	Bet-tye	Our daily volume of goods is measured in millions of pieces. We have more than 260 warehouses in total, and the flow of goods varies from city to city. But on average, there are hundreds of thousands of items coming in and out of Jane's every day. So the daily flow of 10 million pieces is definitely there.	LV
3.13	HK	Thank you! I was checking the company information and found that the company has set up its own logistics company, XX Logistics is it?	
3.14	Bet-tye	Yes. Please remove the name of our subsidiary here.	
3.15	HK	Okay, we'll keep the name of the company confidential. So how did the idea for a dedicated logistics subsidiary come about?	
3.16	Bet-tye	First of all, this is a bit related to the characteristics of our company's business. Our company is a retailer of home appliances, so in addition to the TVs and fans I mentioned before, there are also large appliances like air conditioners, refrigerators and washing machines. The transportation of large appliances is very different from the transportation of small items. If you buy a piece of clothing online, it's not particularly difficult to have it delivered in 2-3 days. Why? Because the costs and requirements for transporting such small items are very low. It can be thrown, crushed and even rained on during transport. But not so with large appliances. First of all it is very large, which makes it very difficult to transport. A refrigerator that is packed in a box would require at least two adult males to move it, in addition to the use of tools. Moreover, during the transport of a large appliance, it cannot be inverted, stepped on or drenched in rain. Otherwise it is easy to damage parts. The delivery of large appliances, moreover, requires a one-to-one door-to-door service. It is not possible for customers to pick up their goods at the counter themselves. If you were to find a logistics	LR, LC

		company in China that met these requirements, the cost of delivery would be very high. What's more, our daily business volume is very high, with tens of thousands of orders per day, and the logistics costs would be too high if we were to find another logistics company. That's why we set up our own logistics department from the very beginning of our company. As our business grew, we set up our own logistics subsidiary specifically for logistics transport.	
3.17	YL	Thank you for sharing your thoughts. And can you elaborate on the changes in the company's logistics business volume in recent years?	
3.18	Bettye	Our logistics business has grown very rapidly. When I joined the company, it was around 2008. At that time, the volume of goods flow was only a hundred thousand pieces a day and there were less than 200 shops nationwide. But now the logistics business is already in the tens of millions of pieces. That's an increase of more than a hundred times! And since we set up our subsidiary, in addition to our internal logistics, we also undertake other businesses' logistics commissions.	LV
3.19	YL	Thank you. And do you think your company's logistics system has brought any benefits to the company?	
3.20	Bettye	As I said before, our logistics system is a very important part of our company's business and above all our own logistics system helps us to save a great deal of money. Even after we have set up a logistics subsidiary, it can bring us an additional amount of revenue.	LV,LC
3.21	YL	Thank you for sharing your thoughts. Have you ever heard of the concept of "intelligent logistics"?	
3.22	Bettye	Well, you've certainly heard of it. We've been thinking about introducing intelligent logistics since before we set up our subsidiary. We later divided the company's logistics department specifically to become our subsidiary. This was the right time to take advantage of the re-integration of the company's business processes to incorporate intelligent logistics.	
3.23	HK	Can you share with us one or two examples of companies that have been successful in using intelligent logistics?	
3.24	Bettye	We have many success stories. For example, we have a centralized distribution strategy. At the moment, many of our shops are displaying samples. When a customer purchases a large appliance, it is centrally distributed from the main warehouse, but this requires the shop to know exactly what is in stock and the distribution center to know what is being delivered to where and when. We use	

		cloud computing analysis in the background to integrate customer delivery information. We plan a reasonable route and delivery time, so that one vehicle can deliver 3-4 orders. This greatly improves our delivery efficiency.	
3.25	HK	Thank you! Can you share with us specifically what intelligent logistics technologies you have used?	
3.26	Bettye	Yes, let me tell you about our Smart Warehouse, the unmanned warehouse technology. We have piloted unmanned warehouses in two cities with high order volumes and major transport hubs. In total, we are equipped with more than a hundred intelligent robots. From the traditional logistics model of "people looking for goods" to the intelligent era of "goods looking for people". The traditional mode of picking goods in logistics warehouses is called "people looking for goods", which requires a high level of professionalism and proficiency from the sorting staff. This requires staff to know exactly where to place each item. But now all our items have their own unique code. And we record all this information in our intelligent logistics system. The robots are programmed to move the shelves to the designated locations, enabling unmanned 24-hour working mode.	SW,RO, OT,AI
3.27	HK	Thank you! And has the work of logistics workers changed at all since you applied these technologies?	
3.28	Bettye	The changes for logistics workers have been significant. Previously we had to rely on logistics staff to find the goods themselves and use forklifts to move them. But this was a much less efficient way of working and there were inevitable mistakes made by staff during transport. The situation of picking up the wrong goods, goods damage will also occasionally happen. But from our practical "Smart Warehouse" after the robot picking efficiency compared to the average manual increase of nearly 270%, handling time overall shortened by nearly 30%. Yesterday's figures, for example, showed that in 12 hours, we were able to pick more than 34,500 items, which greatly improved our logistics picking efficiency.	CRC
3.29	HK	Can this be interpreted to mean that the logistics workers' previous duties of finding goods have been replaced by robots?	
3.30	Bettye	Yes, it can be interpreted in this way. Our logistics staff only need to assist with emergencies and routine maintenance.	
3.31	HK	Thank you. Has there been any change in the company's revenue as a result of using intelligent logistics technology?	

3.32	Bettye	If we're talking about pure gains, there's not really too much of a noticeable increase. Efficiency is much higher, but our earnings have not changed very significantly. There was even a decline in profits in 2018, 2019.	CRC
3.33	YL	May I ask why the decline in profit was caused?	
3.34	Bettye	First of all, it is the cost of maintaining the system for intelligent logistics. We don't have our own IT team to maintain the system now, so we need to hire a third-party company to develop the system for us. And we have invested in huge upfront R&D and post maintenance costs for the robots. While this has greatly improved our logistics efficiency, it has also increased the cost of the business. This situation will slowly improve as our research and development progresses. According to our logistics data analysis, the overall cost of robots has dropped by around 35 percentage points compared to the cost of labor. Moreover, the robots support 7*24 hours of non-stop work, which ensures the maximum operational efficiency of our Smart Warehouses.	RO
3.35	YL	What approaches will you take to control costs in the future?	
3.36	Bettye	Firstly, we will look for ways to increase revenue by getting more customers early. Secondly, we will build our own IT team to develop and maintain our intelligent logistics system. This will save us a lot of money in terms of computer overheads.	
3.37	HK	Thank you! What do you think of the customer reviews after adopting Intelligent Logistics?	
3.38	Bettye	Customer feedback is getting better and better. Our complaints about logistics have now dropped by 40%. This is a very significant improvement. Even we didn't expect such good results. And especially after this outbreak, more people are choosing to shop online. Our logistics have all been very well received.	
3.39	HK	You mentioned earlier that the XX Logistics subsidiary's profits come from internal orders as well as taking orders from other merchants. Can you elaborate on how the subsidiary slowly started to serve other companies?	
3.40	Bettye	Originally we only delivered for internal sales, but at the same time we also delivered orders from third-party companies that sell on our platform or in our shops. We deliver to any third party company that sells through our online or offline channels. And many merchants trust our level of logistics as well. Our intelligent logistics system, as mentioned before, makes our logistics safer and faster. So third-party businesses ask if we can do delivery for goods they sell on other platforms? So our platform is gradually opening up to the whole community, and our main customer	LV

		groups are companies with large appliances or users who need large deliveries. So among individual consumers, our logistics is not very well known. But among companies, our logistics company's intelligent logistics system is very well known. Because the intelligent logistics system we have built is nationwide, and our home delivery service for large items is standardized. So the cost is also relatively low, which is a big advantage for us to attract customers. Moreover, at present, the demand for bulky delivery is greater than the supply, and we are facing a shortage of logistics companies. This is one of the reasons why our logistics subsidiary has been able to grow rapidly.	
3.41	HK	Okay thank you. You mentioned the change in the work content of logistics workers. What do logistics workers think about the system after the use of the intelligent logistics system?	
3.42	Bettye	First of all, the system is replacing a lot of the physical activities of logistics workers. This is definitely something that makes it easier for them. But at the same time, it means that we have redundant labor. Many logistics workers face the risk of losing their jobs, and this will certainly give them anxiety.	
3.43	HK	As a logistics director, do you have any suggestions or views on this issue?	
3.44	Bettye	I have always been mainly interested in training high-end logistics personnel. After all, more and more companies and logistics companies are now transforming themselves into intelligent logistics. There is a high demand for high level labor. The demand for logistics workers who are engaged in manual labor will be lower and lower. This is the trend of the times and there is no way to avoid and stop it. Therefore, I always suggest that logistics workers should learn more about intelligent logistics-related technologies. For example, computers, how to operate management robots, etc.	
3.45	YL	Thank you for sharing, what is your next step?	
3.46	Bettye	Our next plan is to expand the number and scale of Smart Warehouses. Gradually, we will build our city's intelligent logistics network across the country.	
3.47	YL	Okay thanks! One last question, do you think there is anything you can do to improve intelligent logistics technology in the future?	
3.48	Bettye	I would love for us to have a unified intelligent logistics system. This way we can better communicate with companies in the supply chain and share logistics information in real time. Right now, different companies are using different systems and even different	

		programming languages. This makes it difficult to share our logistics information.	
3.49	YL	Thank you. Are there any other comments?	
3.50	Bettye	No more.	
3.51	HK	Thank you very much and for your help with our experiments. Have a nice day. Bye bye	
3.52	Bettye	Bye	

Appendix 4 -Transcription of interview 4

Interviewer 4: Hira Khalid (HK), Yujie Li (YL)

Respondent (R4)

Company: C4

Type of company: A grocery shop chains

Role: Logistics manager of our logistics and distribution department

Date: May 11th 2021

Interview Length: 1 hour and 3 minutes

Language: English

Number of words: 2563

Row	Person	Transcription	Code
4.1	HK	Hi, can we start the interview now please?	
4.2	R4	OK. I would like to ask you to keep the name of our company and my name confidential. I don't want my name to appear in the interview transcript...	
4.3	HK	Okay, no problem. If there are any sensitive questions or words that need to be kept confidential, please let me know.	
4.4	R4	Yes, I will if there are any.	
4.5	HK	Okay, so we'll start the interview. Can you tell us a little bit about your current job title and responsibilities?	
4.6	R4	Yes, I am the logistics manager of our logistics and distribution department. I'm mainly responsible for our offline distribution work. Our company is different from other traditional grocery shops in that we have shops, but we also offer online purchase and offline delivery. As well as that, consumers can also have their goods delivered to their homes by us after shopping in our shops. This is an online or offline purchase and home delivery service.	
4.7	YL	Thank you. You mentioned earlier that your company is different from traditional grocery shops, can you tell us more about your business and its characteristics?	

4.8	R4	Firstly, we are a large chain of grocery shops. We carry a wide range of products such as daily necessities, fresh produce, small and large appliances and digital products. We have more than 200 shops in over 80 cities. We are also one of the first grocery chains to implement online or offline ordering and home delivery services.	
4.9	YL	Okay, what is the approximate daily logistics volume of the company?	
4.10	R4	It's difficult for me to give you specific figures, the volume of material flow varies from city to city. In the few urban areas I am responsible for, the total daily online order volume is more than 10,000 orders, and the shop delivery orders are more than 1,000 orders. So overall our logistics business is still very large. And because we are a retailer in the FMCG sector, we have a much higher volume of daily deliveries. Especially for fresh produce, there are thousands of trucks on delivery in different cities every day.	LV
4.11	YL	Thank you. You mentioned earlier about starting to offer online purchase, offline delivery service and offline shop purchase, then delivery to home service. Has there been any change in your logistics business volume as your business model has become more diversified?	
4.12	R4	The change in the volume of logistics business has been huge. This is especially true for our fresh produce business. Our consumers tend to place orders for both daily necessities and fresh food for delivery. But in the past, our fresh food warehouses were often not in the same warehouse as our daily necessities. They require different delivery environments. For example, for chilled products, this would require a special cold chain vehicle for delivery. So the changes and challenges brought to us are not only an increase in the volume of logistics business, but also an increase in the complexity of distribution.	LV
4.13	HK	Thank you! This does bring up a lot of new issues. So has the logistics segment had any impact on the revenue side of the company so far?	
4.14	R4	When you say company revenue, do you mean the logistics costs and overheads, or the profits that we generate?	
4.15	HK	You can talk about both.	
4.16	R4	Logistics costs have definitely increased. In particular, we are now moving towards intelligent logistics, and the investment in logistics is increasing all the time. As for the profit	LC,LR

		that logistics brings to our company. This is a difficult question to answer, can you be more specific? Because logistics is generally a cost segment.	
4.17	HK	Well let me explain, for example, the potential revenue from attracting more customers due to your high quality and fast logistics delivery. Or that your own logistics system does a better job of logistics delivery compared to using a third party logistics company, saving you money or something like that.	
4.18	R4	Oh that's right. For sure our own logistics system is less costly than a third party logistics system. After all, our own logistics system is tailored to the characteristics of our company. And the intelligence of our system is comparable to that of other logistics companies. With regard to customer acceptance of our logistics, we have a customer evaluation section for every order. From the data I have so far, the vast majority of our customers are very satisfied.	LR,CS
4.19	HK	Thank you! You talked about intelligent logistics earlier. When did the company start to make logistics intelligent?	
4.20	R4	We started to move slowly towards intelligent logistics back in 2014. It's been seven years now.	
4.21	HK	That's a long time indeed. Can you give us one or two examples of successful intelligent logistics?	
4.22	R4	I would like to share our "Life Warehouse" project, which is also a very important part of our intelligent logistics. The "Life Warehouse" is actually our Smart Warehouse program. Our Smart Warehouse is between 300 and 600 square meters in size, with products mainly in the fresh produce and daily necessities categories, which we have an advantage in. The number of items in stock is kept in the tens of thousands. At the supply chain level, the Smart Warehouse is delivered by our local distribution center directly from the supplier to the warehouse. Not by using the shops as logistics centers, as some companies do. And in terms of site selection, our Smart Warehouses are mainly located around mature communities such as emerging residential and residential areas with strong consumer demand and online consumption habits. In this way the Smart Warehouse can cover the distribution service to a surrounding area of about 3 km	CC,BD, SW

		In terms of storage hardware, the Smart Warehouse has a full temperature zone storage environment including room temperature, refrigerated and frozen, and the goods inside can meet the daily consumption needs of the young urban population and families.	
4.23	YL	Thank you very much for sharing the Smart Warehouse project. Is there any new technology used within the Smart Warehouse?	
4.24	R4	First of all, we have an intelligent logistics system. We started by building an OMS order management system to form a unified management platform for orders, inventory, visualization and other data. This allows us to achieve unified management of orders across multiple channels, both online and offline. Helps us build our logistics database with functions such as overall order pools, inventory centers and supply chain planning collaborative forecasting. It can just help us to analyse the location of our warehouses, the rationing of our merchandise inventory and so on. At the transport level, through effective digital and visualized control methods. To enhance the information interaction between customers, dispatchers, carriers, drivers and shops, reducing manual communication costs. For example, customers can see the location information of our couriers in real time and know the delivery status of their orders. Our suppliers can also get our inventory in real time. We can prepare for deliveries in advance. At the same time, I will have my own logistics settlement management system to achieve refined logistics cost calculation. Through the integration of RP business data, we can calculate the cost of warehousing. This gives us a very clear picture of the logistics overheads for each segment. Through the application of the intelligent logistics platform, we can improve the efficiency and service quality of the logistics supply chain.	BD,ILC, EF
4.25	YL	So is the selection of goods in the current Smart Warehouse done by hand or by machine?	
4.26	R4	Intelligent picking is currently being implemented in some of our warehouses. We have developed an intelligent picking system with a total investment of approximately RMB 30 million. There are approximately 90 robots in place. The commissioning of these picking robots, automatic sorting lines and other intelligent equipment has further reduced labour costs and improved the efficiency of distribution in our intelligent logistics centre. The average picking efficiency of	AGV,RO, SW

		the robots is 153 rows per hour, more than three times that of manual picking. The robots also have a daily shipping capacity of 5,000-7,000 order lines, which can easily solve the shipping needs of shops and warehouses. Another advantage of robotic picking is lower picking error rates, longer working hours and less effort in site management. This allows us to reduce the number of staff on site and achieve cost reductions and efficiencies	
4.27	YL	What is your customer's reaction to using our intelligent logistics delivery service?	
4.28	R4	Our customers rate our intelligent logistics delivery very highly.	CS
4.29	YL	Can you tell us more about the reasons for the high ratings, or the differences between your Intelligent Logistics and other retailers' distribution services?	
4.30	R4	The high customer ratings are due to the fact that our company's logistics delivery is superior to that of other shops. Our intelligent logistics has features such as fast delivery and low breakage rate of goods. The difference between our intelligent logistics and other retailers is that most retailers' delivery operations are "reactive" and created to meet the diverse consumption scenarios of their customers. They often use third-party platforms to do this. However, our intelligent logistics delivery business is completely autonomous, with data and identifiability of member information at its core. This can be reflected in our app is the degree of customer activity. The percentage of class-identified members in our retail shops has reached 80%, which is a very significant achievement compared to our peers.	EF,CS
4.31	YL	Thank you. What do you think about the use of intelligent logistics systems in your company, and what are the views of the logistics staff on this?	
4.32	R4	They were initially rejected. It was clear that many employees' jobs were threatened after we used robotic picking. Some of the smart warehouses have now implemented robotic picking and the number of manual jobs has dropped by half.	EAL
4.33	YL	So how do you see the problem of staff positions being replaced?	
4.34	R4	This is an inevitable trend in the development of smart logistics, and all we can do is to help our employees improve their capabilities.	
4.35	YL	Can you tell us more about how you are improving your employees' capabilities?	

4.36	R4	Okay. Our company conducts courses in computer competence training for logistics employees, machine operation training and theoretical training. Since logistics employees are generally less educated, they are less receptive to mechanized and intelligent logistics systems. What we have to do is not just to lay off staff, but to try to help them improve their abilities. This is also a disguised way of saving our recruitment costs. Through our relevant training courses, some logistics employees have already been successfully transitioned to management positions or equipment maintenance positions. This is good news for our company, and even for society. As a large retail chain, we are obliged to take on a certain amount of social responsibility.	EAL,CR
4.37	HK	Thank you. Has there been any change in revenue or logistics costs since the introduction of intelligent logistics technology?	
4.38	R4	Actually, our costs have gone up. That means that we have relatively had to reduce our revenue. Is this different from what you expected?	CRC, ILC, LC
4.39	HK	It is very different from what I expected. I thought it would increase revenue or reduce costs. Why?	
4.40	R4	That's because it takes money to develop systems, buy robots and form new sorting processes. It's expensive to adapt a new intelligent logistics system. That's why we are gradually moving forward with intelligent logistics. It would be unrealistic to complete the entire transformation of intelligent logistics in a short period of time. The company's capital cannot afford to spend so much.	
4.41	HK	Even though there will be so many costs upfront, what is your view on the future of intelligent logistics?	
4.42	R4	The future of intelligent logistics is definitely one that will reduce logistics costs and increase revenue for companies. In the long run, unmanned picking is far better than manual picking in terms of accuracy and efficiency. That's why we are always on the lookout for intelligent logistics transformation.	LR,ILC
4.43	YL	This one has really given me a new understanding. I hadn't realised that the issue of cost was also a hindrance to the transformation of intelligent logistics.	
4.44	R4	Cost is certainly a reason, and an important one at that. But we also have other reasons.	

4.45	YL	What is the reason for this?	
4.46	R4	The fact is that robotic sorting does not quite meet our expectations nowadays. Of course robotic sorting is excellent in everyday goods.	
4.47	YL	Which are the everyday goods you are talking about?	
4.48	R4	It's household appliances, daily goods and mainly goods other than fresh goods.	
4.49	YL	Is there anything special about fresh goods?	
4.50	R4	The most unusual thing about fresh produce is that it can be perishable and defective. Of course, this can happen with other products too, but it is more common in fresh produce. For example, if an apple is rotten with a hole in it, an intelligent robot cannot recognize the hole and it knows to take the bag of apples. But the manual sorting will be able to weed it out very well. So this is one area where we are not happy with robot sorting.	RO
4.51	HK	Thank you! This area does cause a lot of inconvenience. Do you or the company have any plans for the future?	
4.52	R4	The robotic part? We are always interested in the latest technology. After all, we don't work on robotics. If the latest technology is available, we will certainly consider introducing it.	FP
4.53	HK	Yes, thank you! Do you have any views on the increase in logistics costs for the company? Has the company made any corresponding measures?	
4.54	R4	First of all, there is definitely a need for cost investment. But we will also make use of our existing resources as much as possible to transform and utilise them. For example, we train our logistics staff, and we renovate our cold chain vehicles and logistics vehicles. We add GPS systems to our existing equipment and so on. All in an attempt to control costs.	CR
4.55	YL	Thanks so much. Do you wish to add something more before closing?	
4.56	R4	Nothing I want to add.	
4.57	HK	Thank you! Can we contact you again in case of any additional questions.	
4.58	R4	Yes, sure.	

4.59	YL	Well thank you very much for sharing that!	
4.60	R4	You're welcome and I'm happy to share it with you. I hope it will help you with your paper.	
4.61	HK	You have provided a great deal of help! Have a great day and bye!	
4.62	R4	Bye!	

Appendix 5 -Transcription of interview 5

Interviewer 5: Yujie Li (YL)

Respondent 5 (R2): Xiaojie Ma

Company: Alibaba (Cainiao Smart logistics ltd.)

Type of company: A e-retail company

Role: Algorithm director for the Cainiao Logistics project of the Alibaba Group.

Date: May 12th 2021

Interview Length: 2 hour and 5 minutes

Language: Chinese

Number of words: 7801

Row	Person	Transcription	Transcription(Translated)	Code
5.1	YL	你好，请问我们现在可以开始访谈了吗	Hello, can we start the interview now?	
5.2	Xiaojie	好的随时都可以。.	Okay anytime...	
5.3	YL	好的，请问我可以公开你的姓名、职位和公司名称吗？	Okay, can I please disclose your name, title and company name?	
5.4	Xiaojie	可以的，没问题	Yes, no problem.	
5.5	YL	谢谢。如果有涉及到任何敏感信息你可以告诉我	Thank you. If there is any sensitive information involved you can let me know	
5.6	Xiaojie	好的，如果有的话我会说的。	Yes, I'll tell you if there is.	
5.7	YL	好的那我们现在开始正式访谈。能先请您介绍一下您目前的工作岗位和工作职责吗？	Okay, so we'll start the interview now. Can you start by telling us about your current position and job duties?	

5.8	Xiaojie	我目前在阿里巴巴集团下的菜鸟物流项目担任算法总监。主要做的是菜鸟物流的智能路线规划算法的内容。说的通俗一点就是提高我们目前的订单处理效率和缩短物流配送时长。我们菜鸟物流有一个智能物流计划希望在未来两年中可以做到中国地区订单24小时内送达，全球订单 72 小时送达。我们正在为这个计划做相应的算法规划。	I am currently working as an algorithm director for the Cainiao Logistics project under the Alibaba Group. The main thing I do is the intelligent route planning algorithm content of Cainiao Logistics. To put it in layman's terms, this is to improve our current order processing efficiency and reduce logistics delivery time. We have a smart logistics plan to deliver orders within 24 hours in China and 72 hours globally in the next two years. We are working on the corresponding algorithm planning for this plan.	
5.9	YL	谢谢。那能请您介绍一下你们公司：菜鸟物流吗？	Thank you. Can you please tell us about your company, Cainiao Logistics?	
5.10	Xiaojie	好的，我们菜鸟物流公司是专注建立智能物流网。将通过自我创建、与目前的物流公司共同建设，与供应商合作等等多种模式，在全中国、甚至全世界范围内形成一套开放的智能仓储设施网络。同时利用先进的互联网技术，建立共享数据应用平台。为电子零售企业、第三方物流服务商、供应商等各类企业提供优质服务。帮助物流行业向高效率，低消耗的智能物流发展，提升物流服务品质。我们的智能物流系统会对生产流通的数据进行整合，实现信息的高速流转和实时共享。从而尽量减少货物流动，提升物流效率，降低成本。我们希望这种新的智能物流运作模	Yes, we at Cainiao Logistics are focused on building an intelligent logistics network. We will form an open network of intelligent warehousing facilities throughout China, and even the world, by creating our own, building with current logistics companies, cooperating with suppliers, and other models. At the same time, advanced internet technology will be used to establish a shared data application platform. To provide quality services for e-retailers, third party logistics service providers, suppliers and other types of enterprises. To help the logistics industry move towards high-efficiency, low-consumption intelligent logistics and improve the quality of logistics services. Our intelligent logistics system will integrate the data of production and circulation to achieve high-speed information flow and real-time sharing. This will minimise the flow of goods, improve logistics efficiency and reduce costs. We hope that this new intelligent logistics operation mode can overturn the traditional logistics mode of the past.	CR

		式可以颠覆以往的传统物流模式。		
5.11	YL	好的谢谢！听您说到菜鸟智能物流公司是阿里巴巴旗下的物流公司。请问你们公司的发展史是怎么样，为什么阿里巴巴作为中国甚至是全球型大型零售企业会想成立自己的物流公司呢？	Okay, thanks! I heard you mention that Cainiao Intelligent Logistics is a logistics company under Alibaba. What is the history of your company and why would Alibaba, a large Chinese or even global retailer, want to set up its own logistics company?	
5.12	Xiaojie	“菜鸟智能物流”是 2013 年由阿里巴巴集团还有中国四大主流物流公司（申通、圆通、中通、韵达）这四家物流公司，以及相关金融机构共同合作共同组建的。所以菜鸟物流不是纯阿里巴巴的子公司，只是阿里巴巴占股为 51%，在董事会 7 席中占有 4 席。	"Cainiao Intelligent Logistics was established in 2013 by Alibaba Group, four other major logistics companies (Shentong, Yuantong, Zhongtong and Yunda), and relevant financial institutions. Therefore, Cainiao Logistics is not a pure subsidiary of Alibaba, except that Alibaba owns 51% of the shares and holds 4 out of 7 seats on the board of directors.	
5.13	YL	谢谢！那贵公司是怎么会想到成立菜鸟智能物流呢？	Thank you! So how did your company come up with the idea of setting up Cainiao Smart Logistics?	
5.14	Xiaojie	为什么我们要成立菜鸟智能物流呢？最初我们发现在中国，甚至很多智能物流行业不发达的国家都存在这一个问题。物流规模很大，但是效率很低。就用数据而言，2020 年中国物流成本占总 GPD 约 15% 左右，而欧洲美洲只占 8% 左右。占比约高，说明物流行业效率越低。而中国物流费用的市场总量为 10 万亿级别	Why did we want to set up Cainiao Smart Logistics? Initially, we found that this problem existed in China, and even in many countries where the smart logistics industry is not well developed. The scale of logistics is very large, but the efficiency is very low. In terms of using data, logistics costs in China will account for around 15% of total GDP in 2020, while in Europe and America they will only account for around 8%. The higher the share is, the less efficient the logistics industry is. The total market for logistics costs in China is in the order of $10 trillion, and every 1% reduction in logistics costs will result in hundreds of billions of dollars in revenue.	LV,LR

		的，每下降 1%，对应的收益都是千亿级别。		
5.15	YL	谢谢。你们公司现在每天的物流量是多少呢？	Thank you. What is your company's current daily traffic volume?	
5.16	Xiaojie	我们菜鸟智能物流平台的一年处理包裹量已经超过 400 亿件。仅仅是 2020 年双十一当天的物流量就到达 23 亿件。	Our Cainiao intelligent logistics platform already handles more than 40 billion parcels a year. In 2020 alone, the volume of goods handled on Double 11 Day reached 2.3 billion pieces.	LV
5.17	YL	这个物流业务量是十分惊人了。那近年来这个物流业务量有什么变化吗？	This is a very impressive volume of logistics business. How has this volume of logistics business changed in recent years?	
5.18	Xiaojie	我们的物流业务量每年都在发生巨大的增长。今年我们的包裹收件量就同比增长了 100%。	The volume of our logistics business has been growing tremendously every year. This year alone, we have seen a 100% year-on-year increase in the number of parcels received.	LV
5.19	YL	这个增长量非常大啊，翻了一倍。	That's a very big increase, double the amount.	
5.20	Xiaojie	这就只是今年的数据。如果你再对比前几年的数据，那可是增长了 5、6 倍了。	And that's just this year's figures. If you compare it to previous years, it's a five or six-fold increase.	LV
5.21	YL	谢谢，那您觉得物流服务对贵公司收入方面起到什么作用呢？	Thank you, and what do you think the role of logistics services is in terms of your revenue?	
5.22	Xiaojie	物流服务我们要从两方面来看了，一个是从对客户角度而言。如果一个包裹他们当天下单，今天晚上或者明天就能到了。那他们肯定是很愿意再在这个平台上下单的。这对零售商是非常重要的。所以我们在客户评价环节有专门物流服务的评价。而且除	We have to look at logistics services from two perspectives, one is for the customer. If they order a parcel on the same day, it will arrive tonight or tomorrow. Then they will be very willing to order again on this platform. This is very important for retailers. That's why we have a dedicated logistics service rating in the customer evaluation section. And in addition to the speed of logistics, the quality of logistics is also important. In recent years we have also seen fewer com-	LR,ILC,CS

		了物流速度之外，物流质量也是很重要的。近年来我们物流受到商品损害的投诉事件也是越来越少了。今年比去年的投诉量减少了 30%。第二是物流服务效率的提升也能降低我们物流成本。我们排除物流改革的投资外，单件商品的物流成本以及下降了 20%。即使在全球疫情，运输价格暴涨的同时，我们还能做到成本下降。这就可以体现物流对于公司成本和用户体验的重要度了。	plaints about damage to goods from logistics. This year we have reduced the number of complaints by 30% compared to last year. The second is that the improvement in the efficiency of logistics services can also reduce our logistics costs. We exclude investments in logistics reform, the logistics cost of a single commodity as well as down by 20%. We have been able to achieve cost reductions even while global epidemics have caused transport prices to skyrocket. This shows how important logistics is to the cost of the company and the user experience.	
5.23	YL	谢谢您！您之前提到您的岗位是只能物流系统的算法总监，那您是在什么时候接触智能物流这个概念的呢？	Thank you! You mentioned earlier that your role is that of Director of Algorithms for Logistics Only, when did you first come across the concept of smart logistics?	
5.24	Xiaojie	我们很早就接触”智能物流”这个概念了。早在我们成立”菜鸟智能物流”公司之前，就已经开始研发我们自己的智能物流系统了。当然，在智能物流方法，欧美市场比我们起步早很多。亚马逊很早就开始智能物流的研究了。如果单指我的话，我之前知道人工智能。等我进入菜鸟时，我再开始接触智能物流这个概念的。	We were introduced to the concept of "smart logistics" a long time ago. Long before we set up Cainiao Intelligent Logistics, we had already started developing our own intelligent logistics system. Of course, the European and American markets were much earlier than us in terms of smart logistics. Amazon has been working on smart logistics for a long time. If you refer to me alone, I knew about artificial intelligence before. When I joined Cainiao, I then started to get in touch with the concept of intelligent logistics.	
5.25	YL	那是什么契机想让阿里集团引入智能物流系统的呢？	So what was the opportunity that made Ali Group want to introduce an intelligent logistics system?	

5.26	Xiaojie	首要原因在于当前物流行业存在的问题和伴随而来的机遇。实际上，中国物流存在着总量大而技术不强的问题。我之前就提到过，中国的物流成本占到整个 GDP 的 15%而发达国家仅占 10%。但是符合现代智能化物流要求仓储标准只占 12%。而且目前我们物流市场存在很严重的同质化竞争，导致行业内卷，员工压力过大。员工离职率高，而同时快递服务又层次不齐。同时由于没有很好的规划，会导致重复运输等成本增加，而且加重了环境污染。这些都是物流行业当前亟需解决的问题，也是智慧物流的机会所在。 我们的CEO在会议中就提过，我们作为中国最大的零售商，以及我们平台的个体商户对物流的需求量巨大。我们应该率先搭建起智能物流平台。并基于不同物流场景对架构、技术和算法进行优化， 另外，智慧物流市场是最典型的将传统产业数字化、智能化。人力资源短缺是当前传统行业普遍面临的挑战。货车司机也好，物流仓库内的工作人员也罢，工作环境不佳，而且做的事情也主要是简单重复的重体力劳动，赚的又少，如今愿意做这些工作的人已经越来越少。这次双十一我们派送了	The primary reason lies in the current problems and opportunities that exist in the logistics industry. In fact, China's logistics industry has the problem of large volumes but not strong technology. As I mentioned before, China's logistics costs account for 15% of its GDP, compared to 10% in developed countries. But only 12 per cent meet the standards of modern intelligent logistics. Moreover, there is currently a serious homogenization of our logistics market, which has resulted in industry in-rolls and excessive pressure on employees. The staff turnover rate is high, while at the same time the express service is uneven. At the same time, the lack of good planning can lead to increased costs such as duplication of transport, and aggravate environmental pollution. These are all pressing issues that the logistics industry needs to address at the moment, and where the opportunity for smart logistics lies. Our CEO mentioned in the conference that we, as the largest retailer in China, and the individual merchants on our platform have a huge demand for logistics. We should take the lead in building an intelligent logistics platform. and optimise the architecture, technology and algorithms based on different logistics scenarios. In addition, the smart logistics market is the most typical one to digitise and smarten up traditional industries. The shortage of human resources is a common challenge faced by traditional industries at present. Whether it is truck drivers or staff in logistics warehouses, the working environment is not good and what they do is mainly simple and repetitive heavy physical labour, earning less and less, and nowadays fewer and fewer people are willing to do these jobs. We delivered 1 billion parcels this year, and the number of parcels is still growing by at least 20% every year, so if there are no more people willing to do this work, how are we going to get them out? Therefore, even to keep Ali's business going, Cainiao must also do smart logistics, which is an extremely realistic consideration.	IoT,CC,BD, AI,LR,ILC EF,LC

		10 亿个包裹，包裹数现在每年至少还在以 20%以上的增长率增长，以后要是没有人愿意干这些活，那我们怎么把这些包裹送出去？因此，哪怕是为了把阿里的生意继续做下去，菜鸟也必须要做智慧物流，这是一个极其现实的考虑。 与此同时，智慧物流是阿里国际化发展必须奠定的基础设施。”市场和劳动力供给不足，我们需要承接的商业目标又非常高，这个巨大的鸿沟要靠技术和设备来弥补，这就是菜鸟为什么做智慧物流的最核心的原因。”智慧物流做好了，整个物流行业也会变得更好。对于物流行业的从业者来说可以提升效率、降低成本、减少重复劳动。对于物流行业的消费者来说可以更快地收到快递、甚至做到按需配送。这真的是一个很基础的事情，而且未来效益很高。	At the same time, smart logistics is the infrastructure that must be laid for Ali's international development. "The market and labour supply is insufficient, and the business goals we need to undertake are very high, this huge gap has to be bridged by technology and equipment, this is the most core reason why Cainiao does smart logistics." When wisdom logistics is done well, the whole logistics industry will also become better. Practitioners in the logistics industry can improve efficiency, reduce costs and reduce duplication of effort. For consumers in the logistics industry, they can receive express delivery faster and even do on-demand delivery. It's really a very fundamental thing, and the future benefits are very high.	
5.27	YL	你们不仅仅是对公司收益考虑，更是在为社会做贡献！那你们智能物流的目标是什么呢？	You're not just thinking about your company's earnings, you're contributing to society! And what is the goal of your intelligent logistics?	
5.28	Xiaojie	我们在智慧物流上的目标可以总结为两点：时效更快、成本更低。时效方面，菜鸟的目标是实现中国 24 小时、全球 72 小时必达。	Our goal in intelligent logistics can be summarised in two points: faster time efficiency and lower costs. In terms of time efficiency, Cainiao's goal is to achieve 24-hour delivery in China and 72-hour delivery worldwide.	LR,LC,CR

		与此同时，我们还要降低物流行业的损耗成本。	At the same time, we also want to reduce the cost of losses in the logistics industry.	
5.29	YL	那你们实行中有遇到什么困难吗？	Did you encounter any difficulties in implementing it?	
5.30	Xiaojie	要做到这两点目前，我们必须重新构建我们的物流系统。与早前消费互联网刚刚起步时面临的问题相同，当前传统行业的可用数据也相当匮乏。但是数据是实现智慧物流的大前提。我们首先要通过部署 IoT 设备实现数字化，才能基于数据将算法实现。这就使得 IoT 技术在菜鸟的智慧物流战略中变得异常重要。	To do both of these things we currently have to re-engineer our logistics systems. The same problems faced earlier when the consumer internet was in its infancy, there is currently a considerable lack of available data in traditional industries. But data is a prerequisite for intelligent logistics. We first need to digitise by deploying IoT devices in order to bring algorithms to life based on data. This makes IoT technology incredibly important in Cainiao's smart logistics strategy.	
5.31	YL	那您是否能举一个或者两个公司成功的智能物流的案例吗？	And can you give one or two examples of companies that have succeeded in smart logistics?	
5.32	Xiaojie	我们案例太多了，而且也有很多方面。你想知道的是哪个方面多呢？	We have so many cases and there are many aspects to them. Which aspect would you like to know more about?	
5.33	YL	比如你们运用了什么智能物流技术呢？怎么运用的呢？	For example, what intelligent logistics technology do you use? How was it used?	
5.34	Xiaojie	首先是我们的 IoT 战略。我们不断将物流系统智能化、数字化。我们引入了 AGV、无人车、智能语音助手等前沿技术。前年（2019 年），我们正式推出智慧物流 IoT 开放平台，能够将任意设备连入其中。比如将物流仓库接入平台，仓库本身就成	The first is our IoT strategy. We continue to make our logistics systems intelligent and digital. We have introduced cutting-edge technologies such as AGVs, unmanned vehicles and intelligent voice assistants. The year before last (2019), we officially launched the Smart Logistics IoT open platform, which enables us to connect any device into it. For example, when a logistics warehouse is connected to the platform, the warehouse itself becomes digital. It can be freely dispatched by the user, with an extremely high level of intelligence. The platform system is	IoT,AGV,SW

		为了数字化。可以任由使用者自由调度，智能化水平极高。平台系统还能够根据库存和订单量量身打造出合适的规划算法，并给工人布置任务。	also able to tailor planning algorithms and assign tasks to workers based on stock and order volumes.	
5.35	YL	您能细说一下你们的AGV和无人车技术吗？	Can you tell us more about your AGV and unmanned vehicle technology?	
5.36	Xiaojie	好的，AGV是运用在我们智慧仓库中的一个技术，适用于中小件商品分拣。库中我们使用AGV 机器人矩阵，它们可以互相协作共同完成一个订单，也可以独自执行不同的拣货任务。当机器人低电量时，他们会自主到充电台充电。 在拣货方面我们使用的是可以 360 度运行的机器臂。不仅如此，每一件包裹身上都有智能条码作为 “身份证”，保证货物可以自己找到对应的地点，节约了大量时间。我们测试过，传统仓内拣货员 8 小时行走步数高达 28000 步，拣货 1500 件。然而智慧仓内拣货员一天下来只需 1500 步，拣货已达 3000 件。你可以算算高出了多少倍的效率。	Well, AGV is a technology used in our smart warehouses for picking small and medium-sized goods. In the warehouse we use a matrix of AGV robots, which can work together to fulfil an order or perform different picking tasks on their own. When the robots are low on power, they recharge themselves at a charging station. For picking we use robotic arms that can operate in 360 degrees. Not only that, but each parcel has an intelligent barcode on it as an "ID card", ensuring that the goods can find their corresponding location on their own, saving a lot of time. We have tested that pickers in traditional warehouses walk up to 28,000 steps in 8 hours and pick 1,500 items. However, in the smart warehouse, the picker only takes 1,500 steps in a day and picks up to 3,000 items. You can calculate how much more efficient that is.	AGV,OT,RO
5.37	YL	您说的包裹”身份证”是什么？	What is this parcel "ID" you speak of?	
5.38	Xiaojie	那是我们的智能条形码。这个是我们的数字	That's our smart barcode. This is our digital technology. In 2014 we started using smart barcodes. Each parcel is given a	OT

		化技术。在2014年我们开始使用智能条形码。每个快递包裹，都相当于被装上了一张独一无二的”身份证”，变得可以被实时追踪。而且我们的智能条形码统一了各种数据标准。这使得订单生成时，系统就已经规划出了快递路径，分拣与配送也可以提前安排。	unique ID card and can be tracked in real time. And our smart barcodes unify various data standards. This allows the system to map out the delivery route when the order is generated, and picking and delivery can be arranged in advance.	
5.39	YL	谢谢。那在使用了这些智能物流技术后，消费者有什么评价吗？	Thank you. And what are consumers saying after using these smart logistics technologies?	
5.40	Xiaojie	我们不管是国内的淘宝网站，还是国际的阿里国际，客户对我们物流评价都是越来越高的。如果你来参观我们的公司，你能看到我们有一块屏幕是轮流滚动客户的物流评价。现在”物流快”、”包裹完整”、”取货快”等评价是非常多的。	Whether we are a domestic Taobao site or an international Ali International site, our customers are rating our logistics more and more highly. If you come and visit us, you can see that we have a screen that scrolls through our customers' logistics reviews on a rotating basis. There are many comments such as "fast logistics", "complete package" and "quick pick-up".	CS
5.41	YL	谢谢，那客户是给出了很高的评价啊。使用了智能物流系统后，物流工人对智能物流又有什么看法呢？	Thank you, that's a very high rating from our customers. What do the logistics workers think of the intelligent logistics system after using it?	
5.42	Xiaojie	首先我要更正你一个观点。几千号员工，并没有一个员工是快递员，也没有一辆物流运输车。我们的仓库是靠无人机和 AGV 管理的，我们的投递任务是由各大快递公司进行配送的。我们中心做的是为各个快递公司、零售企业提供一个智能的物流	First of all I would like to correct you on one point. None of the thousands of employees are couriers, nor do we have a single logistics delivery vehicle. Our warehouse is managed by drones and AGVs, and our delivery tasks are carried out by major courier companies. What we do at the centre is to provide an intelligent logistics system for the various courier companies and retail businesses. Especially for the many individual retailers on our Alibaba platform, to provide an efficient logistics network. Also to	MD

		系统。尤其是对我们阿里巴巴平台上的众多个体零售商，提供一个高效的物流网络。同时为中国打造一个高效低能耗的物流体系。我们的员工更多的是算法师、编程员等，还有的是机械、仓库维护管理人员。少部分的是仓库的辅助拣货人员。从我们选人一开始，就是以高技术、高能力、高素质的要求选拔的。他们都是对智能物流保持赞同、希望其不断提高完善的态度的。	create an efficient and low energy consumption logistics system for China. More of our employees are algorithmics, programmers, etc., and some are mechanical and warehouse maintenance managers. A small number of them are auxiliary pickers in the warehouse. From the very beginning of our selection process, the people are chosen for their high level of skill, competence and quality. They are all in favour of intelligent logistics and want it to be constantly improved and perfected.	
5.43	YL	好的谢谢您。目前公司的智能物流系统还有什么需要提高的地方吗？	Yes, thank you. Is there anything else that needs to be done to improve the company's smart logistics system at the moment?	
5.44	Xiaojie	目前我们还在不断完善我们的智慧仓库。虽然仓库内的上百台 AGV **搬运机器人可相互合作，或者独立完成**订单的集货任务。但是我们任然需要人工的配合。当机器人收到拣货员的指令后，就会将要出货的货架拉至拣货员面前，以利于拣货员进行拣货作业。不过从头到尾，仅有搬运机器人将货架移至拣货员面前来进行人工拣货，并没有拣货机器人来进行。也就是说我们的智慧仓库目前是无法 100% 无人操作，仍需要人工与机器配合操作。这是我们日后需要优化的地方。	We are still in the process of improving our Smart Warehouse. Although the hundreds of AGV handling robots in the warehouse can work together or independently to collect orders. However, we still need manual cooperation. When the robots receive instructions from the picker, they pull the shelves to be shipped in front of the picker to facilitate the picking operation. However, from start to finish, only the handling robots will move the shelves to the picker to carry out manual picking, and no picking robots to carry out. This means that our smart warehouse is currently not 100% human-free and still needs to be operated by a combination of humans and machines. This is something we need to optimise in the future.	FP,RO

5.45	YL	谢谢，那您觉得使用智能物流之后，公司的收入有什么变化吗？	Thank you. Do you see any change in revenue after using Smart Logistics?	
5.46	Xiaojie	其实就像我之前说的，我们研发了智能物流系统，不是为了我们公司的利益，而是为了中国物流系统的利益。所以我们关注的不是我们公司收入，而是我们国家的物流智能化程度，物流成本是否下降了。	In fact, as I said before, we have developed an intelligent logistics system, not for the benefit of our company, but for the benefit of China's logistics system. So we are not concerned about our company's income, but whether our country's logistics are intelligent and whether logistics costs have gone down.	LR
5.47	YL	不好意思，那您觉得目前物流系统的改变是什么呢？	Sorry, so what do you think is changing in the logistics system at the moment?	
5.48	Xiaojie	目前智能仓库和大数据算法确实提高了我们的物流效率。现在物流平均达到天数已经缩短了 0.8 天。随着我们智慧物流在更多城市的普及，这个效率会越来越高。	The current smart warehouses and big data algorithms have really improved the efficiency of our logistics. The average logistics reach days have now been reduced by 0.8 days. As our smart logistics becomes more popular in more cities, this efficiency will get higher and higher.	CRC,EF
5.49	YL	那智慧物流是否给整个物流体系增加了成本呢？	So does smart logistics add cost to the whole logistics system?	
5.50	Xiaojie	如果你说的是前期投资，那是的。目前阿里集团已经投资了一千亿发展菜鸟智能物流。但是对于全国的物流成本而言，那是降低了成本的。比如拣货时间，机器人平均每个包裹比人工降低了 6 分钟。那我们一年 400 亿的包裹，将要降低多少时间？节约了多少人工成本？这个数量和金额是无法估算的。	If you're talking about upfront investment, then yes. The Ali Group has now invested 100 billion in developing Cainiao smart logistics. But for the national logistics costs, that is lowered costs. For example, picking time, robots have reduced the average time per parcel by 6 minutes compared to manual. So how much time will be reduced for our 40 billion parcels a year? How much labour cost has been saved? It's impossible to estimate this amount and quantity.	LC,ILC

5.51	YL	非常感谢您的分享。那您对未来工作有什么计划吗？	Thank you very much for sharing your thoughts. And do you have any plans for future work?	
5.52	Xiaojie	下一步我们要在更多城市实行智能物流配送，同时我们也要更加关注环境的可持续性发展。在节约时间、降低成本的同时，也要保护环境。	The next step is to implement smart logistics delivery in more cities, and we also need to pay more attention to environmental sustainability. We want to save time and reduce costs, while at the same time protecting the environment.	SS,FP
5.53	YL	您能详细说一下可持续性发展吗？	Can you tell us more about sustainability?	
5.54	Xiaojie	事实上，我们一直致力于推进零售商物流环保。通过绿色包裹、绿色回收、绿色智能、绿色配送四大具体措施推动绿色物流发展。此外，阿里巴巴从去年起，就建设绿色包装联盟，有很多跨国企业正在规模化的使用环保快递箱	In fact, we are always committed to promoting environmentally friendly logistics for retailers. We are promoting green logistics through four specific measures: green parcels, green recycling, green intelligence and green delivery. In addition, Alibaba has been building a green packaging alliance since last year, and there are many multinational companies that are using environmentally friendly delivery boxes on a large scale	SS
5.55	YL	谢谢您的分享。那您对目前智能物流技术有什么不满的地方吗？	Thank you for sharing your thoughts. And do you have any dissatisfaction with the current smart logistics technology?	
5.56	Xiaojie	我们国家的物流技术起步较晚，还有很多数据、标准不统一的情况存在。这使得致数据不能做到实时共享。希望能够通过各个企业和政府共同发起倡导和整改，使得整个物流体系做到一体化标准。	Our country's logistics technology started late, and there is still a lot of data and standards that are not uniform. This makes it impossible to share data in real time. I hope that through the joint initiative of enterprises and the government, we can promote and rectify the situation so that the whole logistics system can be integrated and standardised.	FP
5.57	YL	谢谢您的观点。这次访谈中涉及到的数据和其他公司名称我可以公开吗？	Thank you for your views. Can I disclose the data and other company names involved in this interview?	

5.58	Xiaojie	可以的。这里没有敏感词汇。	Yes, you can. There are no sensitive words here.	
5.59	YL	谢谢你。在结束之前，你是否希望再补充一些东西？	Thank you. Do you wish to add something more before closing?	
5.60	Xiaojie	我想就这些了	I think that is all	
5.61	YL	非常感谢你。如果有任何其他问题，我们可以再次联系你吗？	Thank you so much. Can we contact you again in case of any additional questions?	
5.62	Xiaojie	是的，当然可以。	Yes, of course.	
5.63	YL	非常感谢您今天的分享。也非常抱歉今天打搅了您这么久。祝您有个愉快的一天	Thank you very much for sharing your views today. I am sorry to have disturbed you for so long today. Have a good day.	
5.64	Xiaojie	好的谢谢，你也是。	Thank you, you too.	

Appendix 6 -Transcription of interview 6

Interviewer 6: Hira Khalid (HK), Yujie Li (YL)

Respondent (R6)

Company: Amazon

Type of company: A e-retail company

Role: Algorithm technical manager in the logistics department

Date: May 13th 2021

Interview Length: 1 hour and 47 minutes

Language: English

Number of words: 3527

Row	Person	Transcription	Code
6.1	YL	Now I would like to start our interview precisely, are you ready please?	
6.2	R6	Yes, you can start the interview whenever you want...	
6.3	YL	Okay thanks, so let's start with the first question. Could you please give us a brief description of your position?	
6.4	R6	I'm an algorithm technical manager in the logistics department at Amazon Logistics.	
6.5	YL	Thank you. Amazon Logistics is global, so which part are you specifically responsible for?	
6.6	R6	Yes, Amazon is divided into many countries, there is the UK, France, Germany, USA, etc. I but we use the same set of intelligent logistics systems. The algorithms are common to the whole system, although they may change in each country for local cost reasons. I am part of the technology center at headquarters.	
6.7	HK	Thank you. Can you give us a brief description of what you do?	
6.8	R6	Our team is mainly responsible for the optimization of robot path algorithms in the Amazon Intelligent Logistics segment.	
6.9	HK	And what are the main responsibilities of your department and your job?	
6.10	R6	Our department is primarily responsible for big data analysis on Amazon. Based on users' purchase history, we have access to thousands of address information. There is also information about the customer's	

		browsing and actual purchases. Based on this data we analyze the current warehouse arrangement, stock planning and also rationalize the number of our intelligent robots.	
6.11	HK	Thank you. And can you give us a brief overview of your company's business scope?	
6.12	R6	Amazon is familiar to everyone, I think I don't need much of an introduction.	
6.13	HK	Amazon is one of the largest online internet retailers in the world and many people know Amazon. But we, as consumers, are more concerned about Amazon's products, logistics and so on. But you, as an internal employee, may have a different opinion about the specific scope of its business or its characteristics.	
6.14	R6	Amazon's business is similar to what you know. Our main business is online retail, which includes products from our own platform and products from third-party merchants. We also have a prime service, which provides faster logistics and premium membership services. In addition to this information that the general public knows about, there are some other businesses that may not have been on the radar. For example, our EC2 servers at Amazon.	
6.15	HK	Thank you. In this interview we would like to talk to you specifically about Amazon as a retailer and its logistics services. What is Amazon's daily traffic volume?	
6.16	R6	Last year, Amazon delivered 2.5 billion packages in the US, of which more than 65% were delivered by Amazon itself.	LV
6.17	HK	So how has this logistics volume changed in recent years?	
6.18	R6	We have seen a significant increase in the number of logistics parcels over the past few years. In particular, after this COVID-19 outbreak, the number of online orders has increased by 20% compared to the same period in previous years. We predicted last year that in 2022 Amazon was on track to catch up with the number of deliveries taken on by UPS and FedEx in the US itself. With the current growth trend, we are on track to meet that target ahead of schedule.	LV
6.19	YL	You mentioned earlier that Amazon has its own logistics and distribution. Do you think that the company's own logistics and distribution play a role in the company's revenue?	
6.20	R6	I think it plays a big role. Our own logistics and distribution, as well as our warehouses, our Intelligent robots and our Intelligent algorithms, all play a huge role in our global distribution environment. Our goal is to build global warehouses and Amazon global is one of the key factors in attracting customers to our website. What we want is for our customers to be able to order what they want through our Amazon platform, regardless of where they are in the world. We can also deliver to any location via our own logistics.	SW,LR, CS

6.21	YL	Since you mentioned that Amazon's logistics is an important factor in attracting customers, can you tell us more about what customers say about Amazon's logistics.	
6.22	R6	Just the logistics is a bit one-sided. Because our Amazon service is more about providing Intelligent warehousing. And we have three different logistics models on our platform, so customers don't tend to care about the specific delivery method we use. But from our user research, and from the reviews they write. There is a lot of trust in Amazon's delivery model.	CS
6.23	YL	You mentioned earlier that there are three modes of logistics on Amazon, can you tell us more about the characteristics of each mode?	
6.24	R6	Our current logistics are FBA, third-party overseas warehouses and third-party merchant self-shipment, FBA's full name is Fulfillment By Amazon, which is what we previously referred to as Amazon Logistics. It is a one-stop logistics service that includes warehousing, picking, packaging, delivery, collection, customer service and returns handling. The seller prepares the goods to the Amazon warehouse, and after the customer places an order, the goods are shipped directly from the Amazon warehouse to the customer. The second model is our third-party overseas warehouse storage service. This is a one-stop control and management service of goods storage, picking, packing and delivery provided by logistics service providers independently or jointly for sellers in their sales target locations. The seller stores the goods in the local warehouse and when the buyer has a demand, the first time to make a rapid response, timely picking, packaging and distribution of goods. For example, if a German Amazon warehouse needs to send an item to Poland, it will be shipped from the local Amazon warehouse, and then the local logistics provider in Poland will be responsible for the delivery service. The third type is the merchant's own delivery. After receiving an order from a customer, the seller ships directly to the foreign customer from a domestic supplier or warehouse. This means that the seller is responsible for a range of activities such as warehousing, picking, packaging, delivery and customer service.	
6.25	HK	Why does Amazon still need overseas warehousing services even though it has its own set of logistics systems?	
6.26	R6	Although FBA solves many problems for sellers, due to our restrictions and requirements for products, as well as high costs, poor flexibility and other problems, which can be solved by third-party overseas warehouses. Compared to FBA, overseas warehouses have certain advantages in cross-border logistics.	LC
6.27	HK	Okay thank you. Then let's talk about the Amazon Intelligent Logistics System. You mentioned earlier that your job is to be responsible for the robot path algorithm in Amazon Intelligent Logistics. When did you first hear about Intelligent logistics?	
6.28	R6	I've heard about Intelligent logistics since I started working at Amazon. I studied artificial intelligence at university. When I arrived at Amazon,	

		I started working on the robotics algorithms for Intelligent logistics. I'm an old employee.	
6.29	HK	Can you tell us about the features of Amazon's Intelligent logistics or one or two success stories?	
6.30	R6	When it comes to the features of Amazon's Intelligent logistics, it's important to mention our Smart Warehouses. In fact, in many countries, we at Amazon offer a warehouse distribution service rather than a logistics service. Before 2018, for example, Amazon's parcels in the US were more likely to be delivered by UPS and FedEx for final distribution. We, on the other hand, provide warehousing and distribution services.	SW
6.31	HK	Can you tell us in more detail how your Smart Warehouse works?	
6.32	R6	Our Smart Warehouse is an integration of our Amazon logistics technology, which involves robotics, big data, Intelligent binning and more. Which would you like to know?	
6.33	HK	We'd like to know all of them if we can. You can talk about them one by one	
6.34	R6	Okay, so let's start with robotics. First of all, we acquired Kiva Systems in 2012 for $775 million, did you know that?	
6.35	YL	We hadn't heard about that, so please continue.	
6.36	R6	Following our acquisition of the Kiva robotics technology, we started by deploying 15,000 robots in 10 Amazon logistics centres in the US from the end of 2013-2014. We then deployed KIVA to its transit centres around the world. As of 2016, we have deployed more than 30,000 Kiva robots in its 13 logistics centres around the world. With the help of the robots, Amazon has been able to save one hour per order processed, reduce pick-up-to-shipment time from taking one and a half hours to 15 minutes, and save approximately $900 million in labour costs annually. 2016 saw KIVA officially renamed Amazon Robotics in an attempt to create a new robotics platform. In addition to developing new AGV robots, it will also work to develop advanced robots that can handle complex aspects such as packing and picking, ultimately achieving the goal of unmanned warehousing.	RO,ILC , LC
6.37	YL	And what exactly do these Kiva robots do?	
6.38	R6	The most important task of the Smart Warehouse is picking. This means that packaged goods are loaded onto trucks that are destined for different areas, according to the different receiving addresses. Our technology, Kiva Systems, allows these robots to automatically find the goods on the corresponding shelves after receiving the order information. The goods are then put into different aisles and loaded onto different lorries. Once our logistics workers have these robots, they simply stand in place and put the packed goods in order onto the robots in front of them, and the job is done. The robots then automatically plan their route around	AGV

		the 125,000 square foot site and load the goods onto the corresponding 300+ trucks.	
6.39	YL	So how do these robots automatically plan routes in a warehouse of this size?	
6.40	R6	First, we equip the robots with a cloud-based route control system. The control system is like a railway scheduling centre, which needs to arrange the route of each robot for each job, and also needs to monitor the entire transport network in real time, for example when there is an accident. In the event of a traffic jam, a record is also generated in time to ensure the system performs properly. In addition, these robots have their own "blind" wayfinding. If you have the opportunity to visit our sorting centre, you will think that the floor looks just like a normal concrete floor. But if you look closely, you can see that the floor is covered with QR Code. These QR Codes are the robot's "blind alley". Whenever the robot reaches a spot with a QR Code, it scans it with a scanner "under the belly". The QR Code also tells the robot whether it should "keep going" or "bend left/right" next. Once instructed, the robot will follow the instructions until it encounters the QR Code that tells it it has "reached the end of the line". Once the robot has transported the goods to the different end points, the robot feeds the goods through the tracks into the chutes at the end points and the goods fall down the chutes into the lorries bound for the different areas. The sorting of the goods by the robot is then complete.	OT
6.41	HK	So that's how it works. I'd seen this sorting robot on a news report before, constantly feeding goods into different chutes. So that's how it works. So how many robots will you put into a logistics centre?	
6.42	R6	One of our Smart Warehouses will be equipped with around 800 robots, but for greater efficiency we tend to put in only 400 to 500.	
6.43	HK	Why isn't it that the more robots you put in, the more efficient you are?	
6.44	R6	Actually, no. You can draw an analogy to big cities, like New York or London. Think about the traffic congestion in every big city. Many people have cars and don't walk too slowly, but the transport system is still so inefficient that people still waste two or three hours a day commuting. The same goes for logistics robots. It's not that more robots are more efficient. Without the support of efficient algorithms, the constant investment in more robots will only create congestion and reduce efficiency. Rationalising traffic flow and minimising congestion is a fairly complex task. This is also a challenge we are tackling.	RO
6.45	HK	You also mentioned your big data application earlier, can you tell us more about this technology?	
6.46	R6	Big data is used in a wide range of ways, not just in our department. The marketing department also uses big data to analyze users' likes and dislikes and to give them occasional tweets. But this is not my area of work, so I won't go into it. Big data helps us with Intelligent logistics mainly by helping us test and design Intelligent picking. We mentioned earlier about the efficiency of logistics robots. In order to understand how many robots are placed at a time and at what speed setting the whole sorting system is most efficient, we have a special simulation	BD,AI

		system. With the help of the simulation system, it is possible to analyze more intuitively how best to configure robots for different order volumes or more complex conditions. And this planning process is supported by big data. Logistics operations driven by intelligent algorithms can ensure optimal paths because a set of data algorithms in the background will randomly optimize the paths of the robots based on their picking, and the system will automatically recommend an optimal picking path to the picker to avoid backtracking and ensure that it has the shortest path after picking.	
6.47	HK	Can you give us a specific example of an optimized path?	
6.48	R6	For example, the placement of Amazon books. Relatively complex book operations often require an enhanced and intelligent monitoring approach. As far as possible, similar items are not placed on the same shelf, and interleaving is used to ensure that the picking workload of each robot is relatively even. It's like the order of the 26 letters on a keyboard. Why are they not placed in the order from A to Z? The reason is to avoid the overuse of similar letters when typing, which can be inconvenient for the fingers.	
6.49	HK	So that's it. Do you use any other Intelligent logistics technology? Like the Internet of Things?	
6.50	R6	The Internet of Things technology is definitely useful. For example, cold chain control, transport security, route optimization, all this requires IoT technology.	IoT
6.51	YL	Can you tell us about the use of Amazon Logistics in this area?	
6.52	R6	For example, road safety. We collect driver and vehicle status data through our devices to detect driver fatigue and vehicle overloading and speeding in time. And we monitor whether the vehicle route is following the established route. If the position is shifted, we will contact the driver in time. And we will use the information collection equipment installed on the vehicle, which can collect information on the condition of the transport vehicle, road conditions, weather and so on. This information will be uploaded to the information center and analyzed to optimize the dispatch of the vehicle.	IoT
6.53	YL	Thank you for talking about so many technologies. And what are the results after applying these technologies?	
6.54	R6	The results are certainly remarkable. Our Kiva robots, for example, are six times more efficient than manual picking and can work in shifts 24 hours a day, something that the traditional logistics industry cannot do. And with our Intelligent logistics technology, we can adjust inventory levels to the lowest possible level and operate with zero inventory.	EF
6.55	YL	Thank you! The merchants we interviewed earlier also mentioned zero inventory operation. What kind of technology does Amazon use to achieve zero inventory?	
6.56	R6	This is one of our Smart Warehouse management methods, called Intelligent binning. The warehouse is based on the supply chain's intelligent big data, close to the stock and predictive allocation. Relying on	BC,SW

		an intelligent global distribution transport network, each warehouse, the major operation centres allocate in advance. Especially before our big promotions. Big data analysis is used to accurately forecast stock requirements. This allows us to plan the distribution of goods, thus reducing the risk of out-of-stocks and stock-outs.	
6.57	HK	What is the current accuracy rate of this management system?	
6.58	R6	The current inventory count is 99.99% accurate	
6.59	HK	This is a very high accuracy rate! Is this obtained entirely by computer algorithms?	
6.60	R6	In addition to the algorithm, we have configured each item with a QR code. Two, each QR code represents an ID card of a stock location, which can be checked in the system to find out where the item is located, thus enabling precise location of the global stock.	OT
6.61	HK	Thank you very much for sharing your thoughts on Amazon's Intelligent logistics technology. So after Amazon implemented Intelligent logistics, what do the logistics workers think about it?	
6.62	R6	The workers are very satisfied. Our Intelligent logistics system has significantly reduced their workload. We used to need 300 workers to pick goods and operate equipment at all times in one warehouse. Now, after we use robots, only 30 managers are needed. The manpower costs have been reduced a lot.	EAL,LC
6.63	HK	But what was originally a 300-person job has become 30 at once. What about the decline in jobs for logistics workers and the increase in unemployment?	
6.64	R6	At the moment we don't have that concern. First of all, I'm not the head of the HR department, so I don't know the exact unemployment rate. But from what I know so far, we are constantly adding new Smart Warehouses and we are constantly needing to recruit new logistics workers. To manage the equipment and also to work together with the robots.	
6.65	HK	But do these new logistics workers need to have some computer knowledge or specialist skills?	
6.66	R6	This is true. Our use of automation technology is not a complete exclusion of manual labour, but a transfer of technology. Instead of having to walk around a 125,000 square foot warehouse centre sporting goods, employees now learn advanced skills such as troubleshooting and dealing with robot malfunctions.	MD
6.67	YL	Okay thanks. And has the use of Intelligent Logistics changed the company's revenue in any way?	
6.68	R6	This has reduced the company's logistics costs, so I guess it has increased the company's revenue.	CRC,LV LR,ILC,CR

6.69	YL	But will Intelligent logistics add extra logistics costs to the company?	
6.70	R6	How will it add extra costs?	
6.71	YL	For example, research and development, investment in renovation and so on.	
6.72	R6	This is definitely the case. We spent billions of dollars to acquire Kiva Robotics. But it's all worth it. How much time can we save per year by saving one hour of delivery time per item? There is an investment in technology at the moment, but in the long term benefits, it's all worth it.	ILC
6.73	HK	And will the company use any methods to reduce costs?	
6.74	R6	First of all, our R&D costs are not going to be reduced. What we do is use better algorithms and work on more new types of technology. In the future we will also develop self-driving technology to deliver goods faster and safer.	FP,ILC
6.75	HK	Do you have any complaints about the current Intelligent logistics?	
6.76	R6	The technology is currently in a state of development and is not as efficient as we would like it to be. Although Amazon's level of Intelligent logistics is already a leader in the retail industry, we know there is still a lot of room for further improvement. Also sustainability is one of the factors we consider. How can we improve the sustainability of our logistics while increasing efficiency and not increasing costs is also something we need to look at in the future.	SS,FP
6.77	YL	Can you tell us more about the sustainability you mentioned?	
6.78	R6	First of all we want to be able to move towards low carbon transport. This includes more use of solar power, electric vehicles and other means of transport. Secondly, there is the issue of reducing parcel returns. This involves parcel security, analysis of customer preferences and so on. These are the responsibilities of other departments.	SS
6.79	HK	Thank you. Do you wish to add something more before closing?	
6.80	R6	No. That’s all.	
6.81	YL	Thank you so much. Can we contact you again in case of any additional questions?	
6.82	R6	Yes, of course. You have my email address. You can send me the questions.	
6.83	HK	Yes! Thank you very much for the interview today. I've learnt a lot from this interview!	
6.84	R6	And thank you. It was a pleasure to talk to you for so long.	
6.85	YL	Thank you! Good luck!	

6.86	R6	You guys too! Bye!	

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